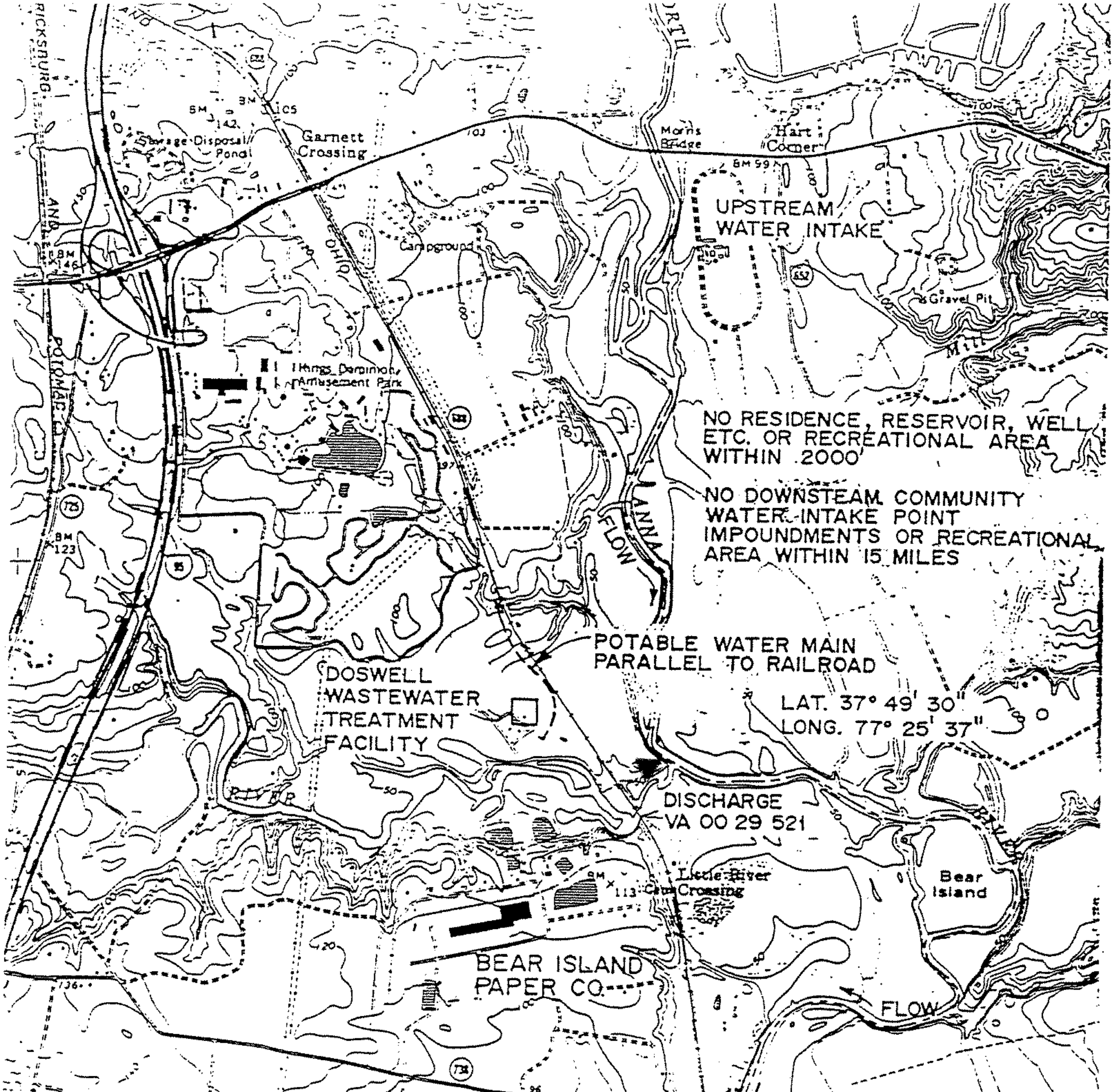
Attachment 1

1. First map identifies outfall location

2. Second map more clearly shows receiving stream. Outfall location is immediately below cross section B. The cross sections designate approximate sampling locations for the dissolved oxygen monitoring required by the permit.



SCALE: 1:24000

1 1/2 0 1 mile

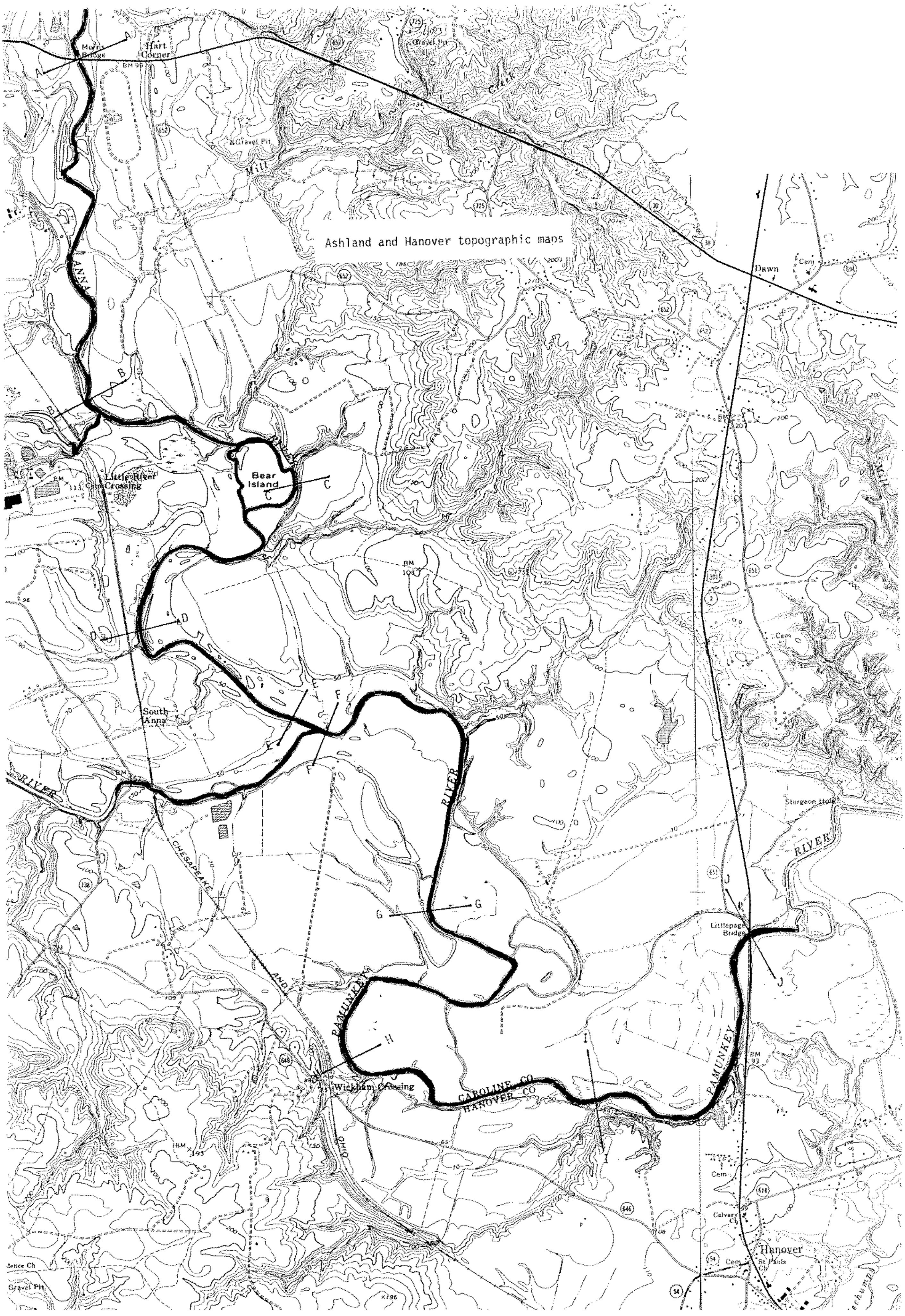
1000 0 1000 2000 3000 4000 5000 6000 7000 ft.

N

TAKEN FROM USGS MAP
ASHLAND QUADRANGLE,
PHOTOREVISED 1985

Figure 1
SITE LOCATION MAP

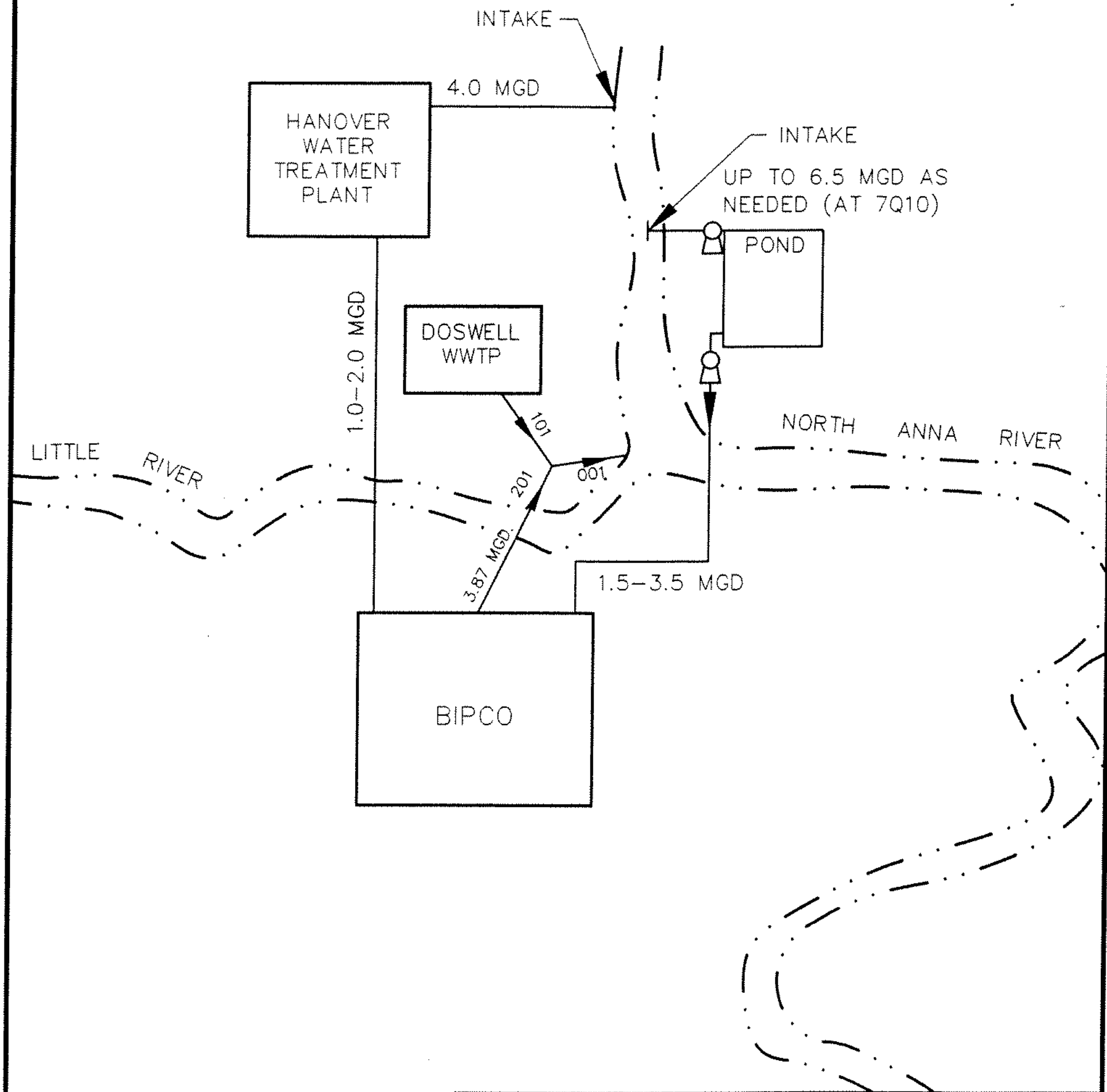
AWARE ENVIRONMENTAL INC


Ashland and Hanover topographic maps
Morris Bridge
Hart Corner
Gravel Pit
Mill
Creek
ANNA
Bear Island
Little River Crossing
South Anna
RIVER
Dawn
Cem
Sturgeon Hole
Littlepage Bridge
CHESAPEAKE AND OHIO
PAMUNKEY
Wickham Crossing
CAROLINE CO
HANOVER CO
Calvary Ch
Hanover
St Pauls Ch
A
B
C
D
E
F
G
H
I
J

Attachment 2

Four schematics are included:

1. Overall water flow schematic
2. Treatment facilities at the Doswell Wastewater Treatment Plant
3. Flow schematic for Bear Island
4. Treatment facilities at the Bear Island Wastewater Treatment Plant



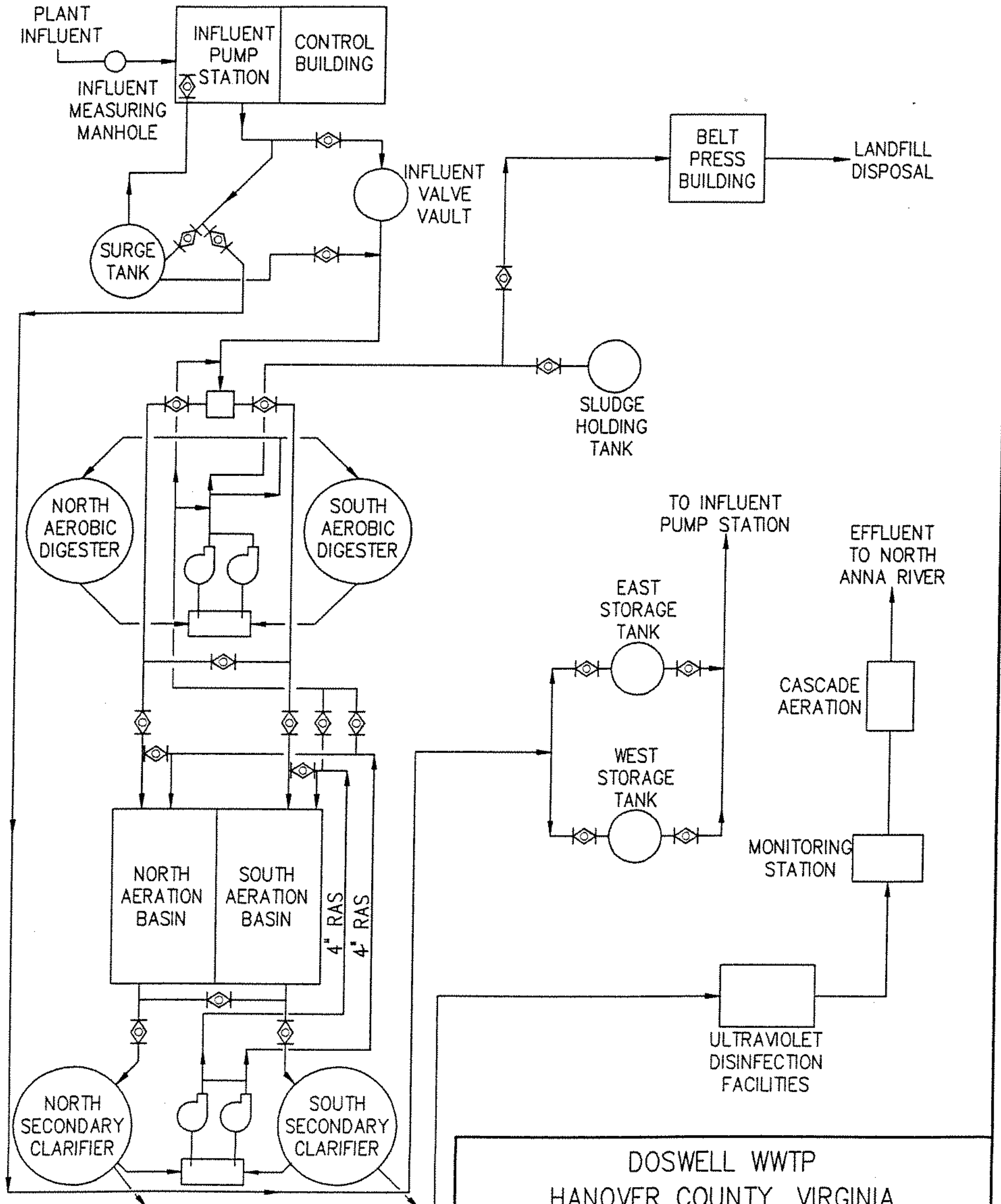
FORM 2c II.A.i
MILL WATER BALANCE

BEAR ISLAND PAPER COMPANY, L.L.C.
WASTEWATER TREATMENT PLANT

SCALE NOT TO SCALE	APPROVED BY :	DRAWN BY: J.K.S.
DATE AUGUST 1999	DESIGNED BY :	REVISED OCT. 1999
PROJECT NUMBER N106-22	AWARE ENVIRONMENTAL INC 9305-J MONROE RD. CHARLOTTE, NC 28270	DRAWING NO. FIGURE

October 18, 1999 2:40:37 p.m.
Drawing: ...N106 1061TPC4.DWG

FIGURE 2

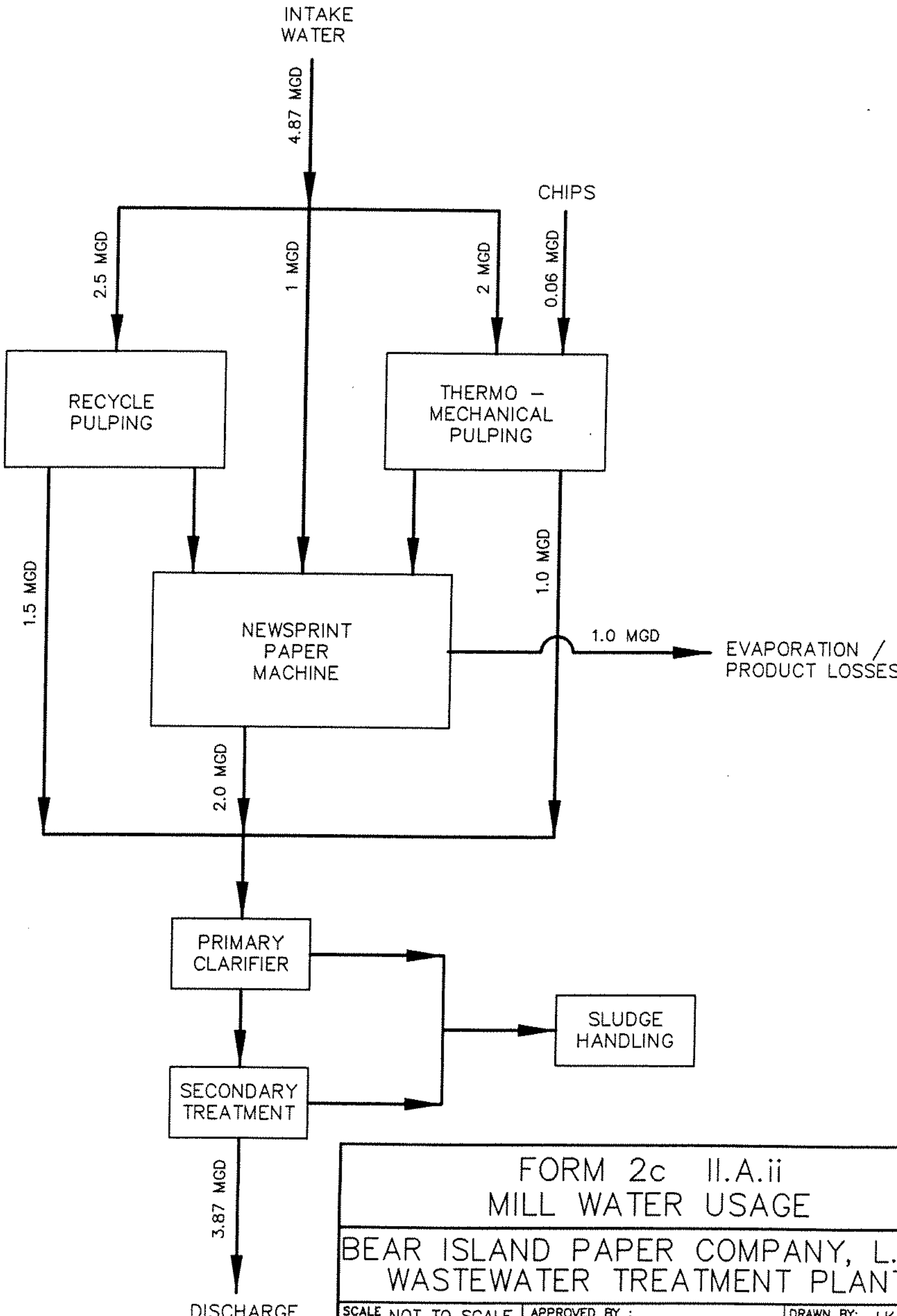


DOSWELL WWTP
HANOVER COUNTY, VIRGINIA

PROCESS FLOW SCHEMATIC

HAZEN AND SAWYER
Environmental Engineers & Scientists

08/04/99 10:53am FILE= t:\2732-034\2732-002 by CRAY XREF FILE = NONE

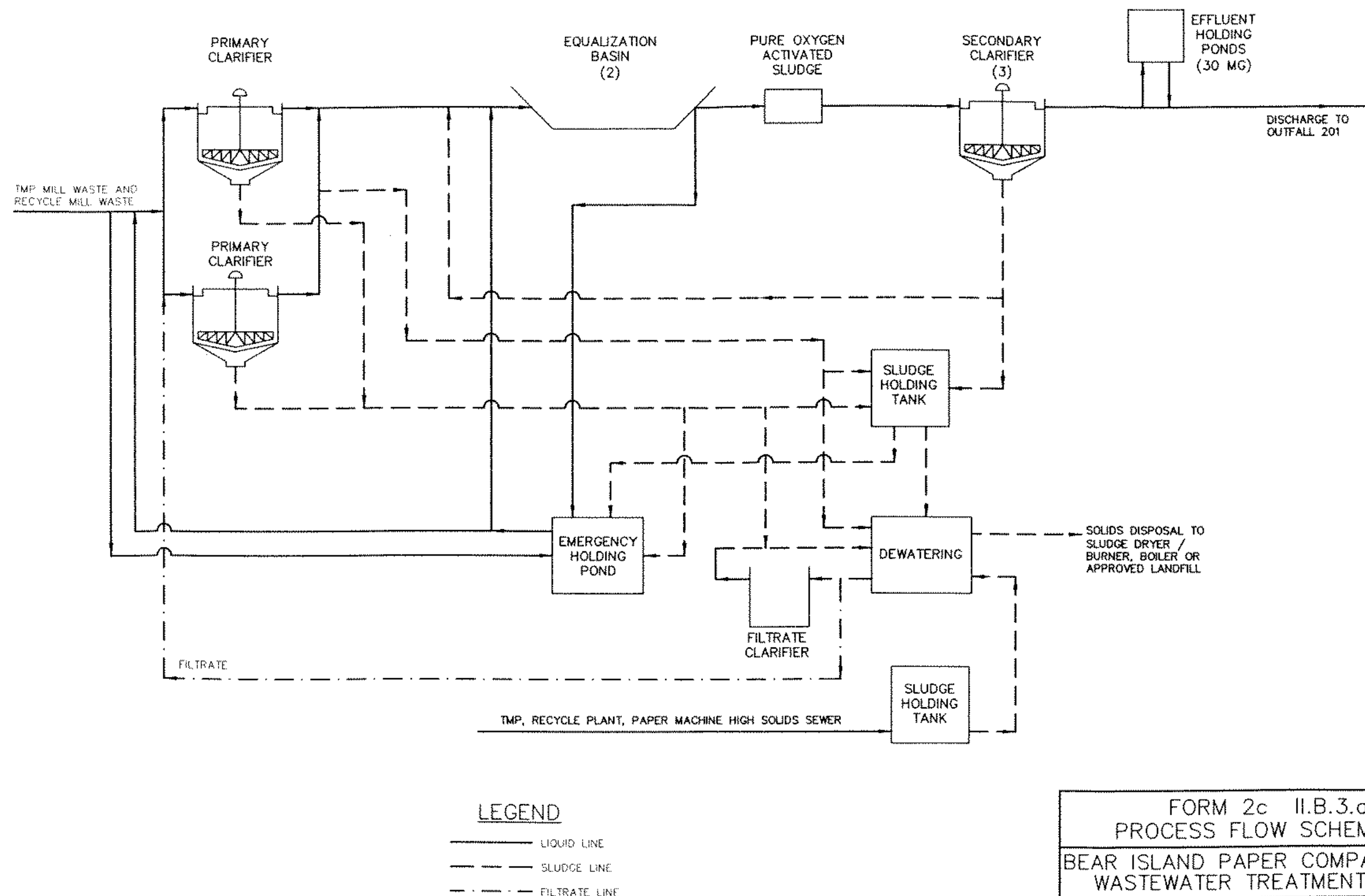


FORM 2c II.A.ii
MILL WATER USAGE

BEAR ISLAND PAPER COMPANY, L.L.C.
WASTEWATER TREATMENT PLANT

SCALE NOT TO SCALE	APPROVED BY :	DRAWN BY: J.K.S.
DATE AUGUST 1999	DESIGNED BY :	REVISED
PROJECT NUMBER N106-22	AWARE ENVIRONMENTAL INC 9305-J MONROE RD. CHARLOTTE, NC 28270	DRAWING NO. FIGURE

August 04, 1999 9:19:24 a.m.
Drawing: C:\DRAWINGS\10617P02-1.DWG



October 18, 1999 10:36:00 a.m.
Drawing: V:\N106\10617P01-1.DWG

FORM 2c II.B.3.a
PROCESS FLOW SCHEMATIC

BEAR ISLAND PAPER COMPANY, L.L.C.
WASTEWATER TREATMENT PLANT

SCALE NOT TO SCALE	APPROVED BY :	DRAWN BY: J.K.S.
DATE AUGUST 1999	DESIGNED BY	REVISED OCT. 1999
PROJECT NUMBER N106-17	AWARE 9305-J MONROE RD. CHARLOTTE, NC 28270	DRAWING NO. FIGURE

Attachment 3

Station ID	Collection Date	Depth Desc	Depth	Temp Celcius	Field Ph	Do Probe	Do Winkler
8-NAR005.42	1/8/1979	S	.30	6.50	7.30		11.30
8-NAR005.42	3/22/1979	S	.30	12.00	7.00		10.50
8-NAR005.42	4/24/1979	S	.30	15.00	7.50		9.80
8-NAR005.42	6/14/1979	S	.30	21.00	7.00		7.20
8-NAR005.42	8/8/1979	S	.30	28.00	6.80		6.40
8-NAR005.42	9/20/1979	S	.30	18.00	7.00		8.40
8-NAR005.42	10/16/1979	S	.30	13.50	7.00		10.00
8-NAR005.42	11/14/1979	S	.30	9.50	7.00		10.50
8-NAR005.42	12/11/1979	S	.30	6.50	7.00		11.60
8-NAR005.42	1/29/1980	S	.30	4.00	7.10		11.80
8-NAR005.42	2/27/1980	S	.30	5.00	6.80		12.40
8-NAR005.42	3/17/1980	S	.30	8.50	6.70		11.20
8-NAR005.42	4/15/1980	S	.30	14.00	7.40		9.30
8-NAR005.42	5/12/1980	S	.30	18.00	7.50		9.00
8-NAR005.42	6/16/1980	S	.30	25.00	7.10		7.80
8-NAR005.42	7/10/1980	S	.30	27.00	6.80		6.80
8-NAR005.42	8/4/1980	S	.30	29.00	7.20		7.10
8-NAR005.42	9/8/1980	S	.30	25.00	6.90		7.20
8-NAR005.42	10/14/1980	S	.30	14.00	7.30		10.40
8-NAR005.42	11/24/1980	S	.30	5.50	6.90		11.40
8-NAR005.42	12/16/1980	S	.30	4.00	6.50		12.20
8-NAR005.42	1/20/1981	S	.30	.50	6.50		11.60
8-NAR005.42	2/17/1981	S	.30	5.50	7.00		12.00
8-NAR005.42	3/18/1981	S	.30	5.00	6.80		11.50
8-NAR005.42	4/16/1981	S	.30	13.00	7.50		11.00
8-NAR005.42	5/12/1981	S	.30	17.00	7.00		8.40
8-NAR005.42	6/15/1981	S	.30	28.50	7.40		8.10
8-NAR005.42	7/14/1981	S	.30	28.00	7.00		7.00
8-NAR005.42	8/12/1981	S	.30	24.70	7.00		6.40
8-NAR005.42	9/10/1981	S	.30	21.50	7.00		7.90
8-NAR005.42	11/19/1981	S	.30	9.00	7.00		5.00
8-NAR005.42	12/8/1981	S	.30	6.00	6.50		12.20
8-NAR005.42	2/9/1982	S	.30	6.00	6.70		9.40
8-NAR005.42	3/24/1982	S	.30	10.00	6.70		9.20
8-NAR005.42	4/28/1982	S	.30	15.00	6.80		
8-NAR005.42	6/29/1982	S	.30	27.00	6.80		5.90
8-NAR005.42	7/28/1982	S	.30	28.50	7.00		5.80
8-NAR005.42	8/18/1982	S	.30	24.50	6.80		6.20
8-NAR005.42	10/19/1982	S	.30	13.00	6.70		9.80
8-NAR005.42	11/17/1982	S	.30		6.70		11.40
8-NAR005.42	12/16/1982	S	.30	8.00	6.50		10.80
8-NAR005.42	1/27/1983	S	.30	3.50	6.70		12.10
8-NAR005.42	2/10/1983	S	.30	4.00	6.50		12.70
8-NAR005.42	3/15/1983	S	.30	12.00	6.70		10.00
8-NAR005.42	4/19/1983	S	.30	11.00	6.50		11.00
8-NAR005.42	5/19/1983	S	.30	17.00	6.80		9.50
8-NAR005.42	6/21/1983	S	.30	24.50	6.80		7.40
8-NAR005.42	7/12/1983	S	.30	26.00	7.00		7.20
8-NAR005.42	11/15/1983	S	.30	7.00	6.50		11.30
8-NAR005.42	12/8/1983	S	.30	8.00	6.00		12.00
8-NAR005.42	2/7/1984	S	.30	3.00	5.90		13.50

Station ID	Collection Date	Depth Desc	Depth	Temp Celcius	Field Ph	Do Probe	Do Winkler
8-NAR005.42	3/5/1984	S	.30	8.00	5.50		12.00
8-NAR005.42	4/26/1984	S	.30	9.00	5.90		9.90
8-NAR005.42	6/4/1984	S	.30	21.50	6.60		7.70
8-NAR005.42	7/2/1984	S	.30	25.00	6.92		7.70
8-NAR005.42	8/6/1984	S	.30	25.00	5.90		7.60
8-NAR005.42	9/5/1984	S	.30	21.00	6.69		12.40
8-NAR005.42	10/10/1984	S	.30	18.50	6.10		6.20
8-NAR005.42	1/7/1985	S	.30	8.00	6.06		11.10
8-NAR005.42	2/20/1985	S	.30	4.50	5.70		12.00
8-NAR005.42	3/6/1985	S	.30	6.50			12.20
8-NAR005.42	4/3/1985	S	.30	10.00	6.50		11.40
8-NAR005.42	5/7/1985	S	.30	20.00	6.50		9.90
8-NAR005.42	6/17/1985	S	.30	22.70	6.80		7.80
8-NAR005.42	7/9/1985	S	.30	24.00	6.20		8.10
8-NAR005.42	8/27/1985	S	.30	24.00	6.40		7.60
8-NAR005.42	9/24/1985	S	.30	20.90	6.70		8.60
8-NAR005.42	10/22/1985	S	.30	15.70	5.95		1.00
8-NAR005.42	12/2/1985	S	.30	11.00	6.50		11.10
8-NAR005.42	1/7/1986	S	.30	3.00	6.30		13.00
8-NAR005.42	2/4/1986	S	.30	6.00	6.60		11.80
8-NAR005.42	3/4/1986	S	.30	6.00	6.70		12.30
8-NAR005.42	4/1/1986	S	.30	16.00	6.90		10.40
8-NAR005.42	5/5/1986	S	.30	16.00	7.06		8.90
8-NAR005.42	6/12/1986	S	.30	27.00	7.51		7.50
8-NAR005.42	7/1/1986	S	.30	24.00	7.58		7.80
8-NAR005.42	8/12/1986	S	.30	24.00	7.47		7.40
8-NAR005.42	9/11/1986	S	.30	22.00	7.70		8.90
8-NAR005.42	10/15/1986	S	.30	16.50	7.50		8.00
8-NAR005.42	11/6/1986	S	.30	9.00	7.25		10.10
8-NAR005.42	12/8/1986	S	.30	5.00	7.60		11.80
8-NAR005.42	1/15/1987	S	.30	9.00	7.56		11.10
8-NAR005.42	2/10/1987	S	.30	3.70	7.24		12.40
8-NAR005.42	3/9/1987	S	.30	11.00	7.81		10.50
8-NAR005.42	4/27/1987	S	.30	14.50	7.35		10.00
8-NAR005.42	5/13/1987	S	.30	20.50	7.30		8.20
8-NAR005.42	6/10/1987	S	.30	22.80	7.10		6.00
8-NAR005.42	7/22/1987	S	.30	29.00	6.63		4.20
8-NAR005.42	7/22/1987	S	.30	29.00	6.63		4.20
8-NAR005.42	8/6/1987	S	.30	27.40	7.00		7.30
8-NAR005.42	8/6/1987	S	.30	27.40	7.00		7.30
8-NAR005.42	9/14/1987	S	.30	25.00	7.49		7.60
8-NAR005.42	10/13/1987	S	.30	11.50	7.86		10.00
8-NAR005.42	11/18/1987	S	.30	14.00	8.06		10.50
8-NAR005.42	12/22/1987	S	.30	9.00	8.54		11.20
8-NAR005.42	1/12/1988	S	.30	1.00	8.16		15.20
8-NAR005.42	3/28/1988	S	.30	12.10	7.64		10.20
8-NAR005.42	4/27/1988	S	.30	17.50	7.58		9.60
8-NAR005.42	5/10/1988	S	.30	19.00	7.29		8.70
8-NAR005.42	6/6/1988	S	.30	21.00	8.82		8.30
8-NAR005.42	7/6/1988	S	.30	24.50	7.10		8.20
8-NAR005.42	8/23/1988	S	.30	22.80	7.57		7.60

Station ID	Collection Date	Depth Desc	Depth	Temp Celcius	Field Ph	Do Probe	Do Winkler
8-NAR005.42	9/19/1988	S	.30	22.00	7.28		8.60
8-NAR005.42	10/6/1988	S	.30	14.00	7.25		9.60
8-NAR005.42	12/8/1988	S	.30				
8-NAR005.42	1/25/1989	S	.30	4.90	6.82		14.30
8-NAR005.42	2/16/1989	S	.30	10.20	7.31		11.50
8-NAR005.42	3/9/1989	S	.30				
8-NAR005.42	4/19/1989	S	.30	15.60	7.86		10.80
8-NAR005.42	5/16/1989	S	.30	14.50	7.30		9.60
8-NAR005.42	6/15/1989	S	.30	25.50	7.00		7.60
8-NAR005.42	7/25/1989	S	.30	28.20	7.00		7.20
8-NAR005.42	8/14/1989	S	.30	23.20	7.32		9.20
8-NAR005.42	9/14/1989	S	.30	24.70	6.74		7.00
8-NAR005.42	10/10/1989	S	.30	11.70	7.65		11.40
8-NAR005.42	11/15/1989	S	.30	17.30	7.33		10.20
8-NAR005.42	12/14/1989	S	.30	4.70	7.40		13.30
8-NAR005.42	1/10/1990	S	.30	6.50	7.05		12.60
8-NAR005.42	2/7/1990	S	.30	10.00	7.30		12.50
8-NAR005.42	3/7/1990	S	.30	8.20	7.90		12.70
8-NAR005.42	4/12/1990	S	.30	12.00	7.86		10.70
8-NAR005.42	5/15/1990	S	.30	18.90	6.46		8.70
8-NAR005.42	6/12/1990	S	.30	21.10	7.73		8.20
8-NAR005.42	7/17/1990	S	.30	25.70	7.34		7.20
8-NAR005.42	8/14/1990	S	.30			7.43	
8-NAR005.42	8/14/1990	B	1.00	25.78	6.97	7.43	
8-NAR005.42	9/17/1990	S	.30	20.10	7.36	7.95	8.00
8-NAR005.42	10/15/1990	S	.30	21.20	6.84	7.50	
8-NAR005.42	10/15/1990	B	1.00				
8-NAR005.42	11/28/1990	S	.30	12.60	7.04	10.16	10.20
8-NAR005.42	12/17/1990	S	.09	9.50	7.34	11.75	11.80
8-NAR005.42	1/15/1991	S	.30				
8-NAR005.42	2/5/1991	S	.30				
8-NAR005.42	3/13/1991	S	.09	7.69	7.39	11.53	11.50
8-NAR005.42	3/13/1991	B	304.50	7.70	7.39		11.50
8-NAR005.42	4/10/1991	S	.09	19.75	7.31	8.91	8.91
8-NAR005.42	4/10/1991	B	.30				
8-NAR005.42	5/8/1991	S	.09	19.30	6.95	8.27	8.30
8-NAR005.42	6/5/1991	S	.30	22.09	7.28		7.79
8-NAR005.42	7/1/1991	S	.30	27.49	6.92	7.06	
8-NAR005.42	8/5/1991	S	.30	25.62	6.40	7.11	
8-NAR005.42	9/4/1991	S	.30	21.50	6.83	8.77	
8-NAR005.42	9/30/1991	S	.30	18.17	7.43	8.87	
8-NAR005.42	9/30/1991	S	.30				
8-NAR005.42	12/3/1991	S	.30	11.57	6.67	9.60	
8-NAR005.42	1/6/1992	S	.30	7.03	6.37	11.79	
8-NAR005.42	2/18/1992	S	.30	6.80	6.45	11.88	
8-NAR005.42	3/4/1992	S	.30	10.50	6.60	11.06	
8-NAR005.42	4/13/1992	S	.30	15.90	6.39	10.05	
8-NAR005.42	5/11/1992	S	.30	16.36	6.01	8.87	
8-NAR005.42	6/10/1992	S	.30	22.86	6.66	7.49	
8-NAR005.42	7/7/1992	S	.30	23.37	6.27	6.78	
8-NAR005.42	8/17/1992	S	.30	21.12	6.02	7.89	

Station ID	Collection Date	Depth Desc	Depth	Temp Celcius	Field Ph	Do Probe	Do Winkler
8-NAR005.42	9/2/1992	S	.30	22.08	6.70	7.86	
8-NAR005.42	10/1/1992	S	.30	14.90	6.53	9.33	
8-NAR005.42	11/3/1992	S	.30	14.67	6.38	11.14	
8-NAR005.42	12/2/1992	S	.30	8.15	6.74	11.20	
8-NAR005.42	1/5/1993	S	.30	10.86	6.41	10.85	
8-NAR005.42	2/1/1993	S	.30	5.82	6.61	11.89	
8-NAR005.42	3/3/1993	S	.30	7.36	6.51	11.55	
8-NAR005.42	4/5/1993	S	.30	11.05	6.38	10.10	
8-NAR005.42	5/4/1993	S	.30	18.58	6.34	8.71	
8-NAR005.42	6/1/1993	S	.30	20.93	6.26	7.89	
8-NAR005.42	7/12/1993	S	.30	28.01	6.44	6.12	
8-NAR005.42	8/9/1993	S	.30	23.28	6.23	7.32	
8-NAR005.42	9/1/1993	S	.30	25.75	6.54	7.30	
8-NAR005.42	10/7/1993	S	.30	14.82	6.89	9.89	
8-NAR005.42	11/2/1993	S	.30	7.89	6.56	11.07	
8-NAR005.42	12/20/1993	S	.30	6.72	6.78	12.03	
8-NAR005.42	1/31/1994	S	.30	4.18	6.60	12.35	
8-NAR005.42	2/10/1994	S	.30	4.99	6.61	12.35	
8-NAR005.42	3/7/1994	S	.30	8.99	6.49	11.63	
8-NAR005.42	4/11/1994	S	.30	15.17	6.47	9.55	
8-NAR005.42	5/11/1994	S	.30	16.64	6.32	9.16	
8-NAR005.42	6/8/1994	S	.30	25.00	6.51	6.81	
8-NAR005.42	7/11/1994	S	.30	26.32	6.55	6.77	
8-NAR005.42	8/3/1994	S	.30	25.62	6.41	6.64	
8-NAR005.42	9/12/1994	S	.30	19.74	6.81	8.17	
8-NAR005.42	10/11/1994	S	.30	14.01	6.65	9.13	
8-NAR005.42	11/1/1994	S	.30	15.69	6.56	8.31	
8-NAR005.42	12/5/1994	S	.30	9.90	6.75	10.65	
8-NAR005.42	1/4/1995	S	.30	4.63	6.72	12.29	
8-NAR005.42	2/1/1995	S	.30	4.69	6.50	12.68	
8-NAR005.42	3/22/1995	S	.30	13.23	6.59	9.37	
8-NAR005.42	4/25/1995	S	.30	13.76	6.91	10.25	
8-NAR005.42	5/24/1995	S	.30	22.13	6.52	7.94	
8-NAR005.42	6/27/1995	S	.30	25.14	6.42	7.41	
8-NAR005.42	7/26/1995	S	.30	28.95	6.72	6.69	
8-NAR005.42	8/31/1995	S	.30	25.15	6.85	7.34	
8-NAR005.42	9/27/1995	S	.30	16.53	6.82	8.54	
8-NAR005.42	10/12/1995	S	.30	16.62	6.65	8.06	
8-NAR005.42	11/8/1995	S	.30	12.54	6.69	10.01	
8-NAR005.42	12/27/1995	S	.30	3.84	6.65	12.78	
8-NAR005.42	1/31/1996	S	.30	6.54	6.13	11.85	
8-NAR005.42	2/27/1996	S	.30	8.34	6.36	10.69	
8-NAR005.42	3/25/1996	S	.30	9.04	6.26	11.42	
8-NAR005.42	4/18/1996	S	.30	13.96	6.56	10.32	
8-NAR005.42	5/30/1996	S	.30	18.14	6.83	9.17	
8-NAR005.42	6/24/1996	S	.30	27.50	6.71	6.86	
8-NAR005.42	7/29/1996	S	.30	25.09	6.84	7.30	
8-NAR005.42	8/26/1996	S	.30	24.52	6.60	6.90	
8-NAR005.42	9/24/1996	S	.30	19.24	6.54	9.81	
8-NAR005.42	10/29/1996	S	.30	16.58	6.46	7.53	
8-NAR005.42	11/25/1996	S	.30	8.04	6.50	11.33	

Station ID	Collection Date	Depth Desc	Depth	Temp Celcius	Field Ph	Do Probe	Do Winkler
8-NAR005.42	12/19/1996	S	.30	9.39	6.57	10.90	
8-NAR005.42	1/27/1997	S	.30	6.27	6.77	12.22	
8-NAR005.42	2/13/1997	S	.30	6.07	6.80	12.83	
8-NAR005.42	3/17/1997	S	.30	8.57	6.74	11.01	
8-NAR005.42	4/9/1997	S	.30	13.30	6.63	9.76	
8-NAR005.42	5/5/1997	S	.30	16.03	6.67	9.14	
8-NAR005.42	6/2/1997	S	.30	20.21	6.35	7.94	
8-NAR005.42	7/2/1997	S	.30				
8-NAR005.42	8/4/1997	S	.30	25.85	6.72	7.19	
8-NAR005.42	9/25/1997	S	.30	17.86	6.96	9.00	
8-NAR005.42	10/22/1997	S	.30	12.70	7.10	10.45	
8-NAR005.42	11/10/1997	S	.60				
8-NAR005.42	11/12/1997	S	.30	13.64	6.77	9.46	
8-NAR005.42	12/8/1997	S	.30	5.86	6.65	12.08	
8-NAR005.42	1/12/1998	S	.30	8.65	6.61	11.46	
8-NAR005.42	2/12/1998	S	.30	8.69	6.78	11.11	
8-NAR005.42	3/12/1998	S	.30	8.62	6.30	11.57	
8-NAR005.42	4/13/1998	S	.30	14.38	6.64	10.30	
8-NAR005.42	5/5/1998	S	.30	16.69	6.49	8.81	
8-NAR005.42	6/1/1998	S	.30	25.76	6.75	7.24	
8-NAR005.42	7/6/1998	S	.30	26.01	6.66	7.11	
8-NAR005.42	8/19/1998	S	.30	25.25	6.56	7.41	
8-NAR005.42	9/15/1998	S	.30	23.23	6.71	6.84	
8-NAR005.42	10/6/1998	S	.30	17.31	6.68	8.46	
8-NAR005.42	11/3/1998	S	.30	11.68	6.50	9.57	
8-NAR005.42	12/14/1998	S	.30	6.98	6.35	11.08	
8-NAR005.42	1/12/1999	S	.30	1.88	6.12	13.52	
8-NAR005.42	2/9/1999	S	.30	5.68	6.46	11.97	
8-NAR005.42	3/16/1999	S	.30	9.10	6.17	11.60	
8-NAR005.42	4/19/1999	S	.30	12.70	6.70	9.88	
8-NAR005.42	5/19/1999	S	.30	20.28	6.48	8.08	
8-NAR005.42	6/22/1999	S	.30	20.95	6.83	8.35	
8-NAR005.42	7/1/1999	S	.30	24.89	6.84	6.64	
8-NAR005.42	8/3/1999	S	.30	25.75	6.83	6.76	
8-NAR005.42	9/1/1999	S	.30	20.21	6.93	8.66	
8-NAR005.42	10/18/1999	S	.30	15.88	6.54	9.01	
8-NAR005.42	11/2/1999	S	.30	14.58	6.28	8.75	
8-NAR005.42	12/28/1999	S	.30	3.71	6.71	13.17	
8-NAR005.42	1/5/2000	S	.30	9.81	6.79	10.38	
8-NAR005.42	2/3/2000	S	.30	3.11	6.54	14.70	
8-NAR005.42	3/1/2000	S	.30	10.80	7.07	10.95	
8-NAR005.42	4/12/2000	S	.30	15.66	6.84	8.90	
8-NAR005.42	5/3/2000	S	.30	17.86	6.93	8.93	
8-NAR005.42	6/7/2000	S	.30	19.10	6.56	7.85	
8-NAR005.42	7/6/2000	S	.30	26.18	6.70	6.66	
8-NAR005.42	8/8/2000	S	.30	26.80	6.58	6.17	
8-NAR005.42	9/12/2000	S	.30	22.74	6.75	6.58	
8-NAR005.42	10/16/2000	S	.30	13.89	6.81	9.33	
8-NAR005.42	11/13/2000	S	.30	9.64	6.79	9.77	
8-NAR005.42	12/27/2000	S	.30				
8-NAR005.42	1/16/2001	S	.30	4.13	6.70	12.53	

Station ID	Collection Date	Depth Desc	Depth	Temp Celcius	Field Ph	Do Probe	Do Winkler
8-NAR005.42	1/31/2001	S	.30	7.65	6.89	11.76	
8-NAR005.42	3/12/2001	S	.30	9.04	6.79	11.15	
8-NAR005.42	4/25/2001	S	.30	18.40	6.84	7.57	
8-NAR005.42	6/11/2001	S	.30	23.25	6.51	7.85	
8-NAR005.42	8/8/2001	S	.30	29.30	7.20	7.92	
8-NAR005.42	10/4/2001	S	.30	18.52	7.00	9.11	
8-NAR005.42	12/27/2001	S	.30	.91	6.11	13.57	
8-NAR005.42	2/5/2002	S	.30	3.36	6.54	12.97	
8-NAR005.42	4/3/2002	S	.30	18.96	6.97	9.51	
8-NAR005.42	6/26/2002	S	.30	28.66	7.80		
8-NAR005.42	7/24/2002	S	.30	26.25	6.65	4.98	
8-NAR005.42	9/19/2002	S	.00				
8-NAR005.42	9/19/2002	S	.30				
8-NAR005.42	11/13/2002	S	.30	13.00	6.37	10.83	
8-NAR005.42	1/2/2003	S	.30	7.84	6.59	11.34	
8-NAR005.42	3/11/2003	S	.30	6.75	7.04	11.90	
8-NAR005.42	5/21/2003	S	.30	18.61	6.60	8.75	
8-NAR005.42	7/10/2003	S	.30	26.91	6.79	6.87	
8-NAR005.42	9/16/2003	S	.30	22.41	6.94	7.65	
8-NAR005.42	11/13/2003	S	.30	15.66	6.94	8.69	
8-NAR005.42	1/21/2004	S	.30	3.69	7.17	12.94	
8-NAR005.42	4/19/2004	S	.30	19.47	6.79	9.18	
8-NAR005.42	5/13/2004	S	.30	23.27	6.86	7.94	
8-NAR005.42	7/13/2004	S	.30	27.15	6.56	6.52	
8-NAR005.42	8/12/2004	S	.30	26.26	6.71	7.31	
8-NAR005.42	9/16/2004	S	.30	24.08	6.90	7.72	
8-NAR005.42	10/5/2004	S	.30	19.65	6.55	9.19	
8-NAR005.42	12/1/2004	S	.30	12.38	7.39	12.42	
8-NAR005.42	12/21/2004	S	.30	3.66	8.64	13.14	
8-NAR005.42	1/19/2005	S	.30	5.13	6.94	13.47	
8-NAR005.42	2/8/2005	S	.30	7.78	6.34	11.65	
8-NAR005.42	3/17/2005	S	.30	8.77	6.38	10.90	
8-NAR005.42	4/21/2005	S	.30	19.30	6.72	8.65	
8-NAR005.42	5/31/2005	S	.30	21.15	7.10	6.42	
8-NAR005.42	6/6/2005	S	.30	24.39	6.39	6.54	
8-NAR005.42	8/3/2005	S	.30	26.97	6.92	6.33	
8-NAR005.42	8/17/2005	S	.30	26.11	6.82	6.54	
8-NAR005.42	9/26/2005	S	.30	22.72	7.04	7.10	
8-NAR005.42	10/13/2005	S	.30	18.02	7.00	8.44	
8-NAR005.42	11/7/2005	S	.30	13.70	6.45	8.72	
8-NAR005.42	12/8/2005	S	.30	5.98	7.20		
8-NAR005.42	1/30/2006	S	.30	8.44	6.59	11.20	
8-NAR005.42	2/28/2006	S	.30	6.67	6.94	12.40	
8-NAR005.42	3/23/2006	S	.30	9.70	7.20	11.50	
8-NAR005.42	4/25/2006	S	.30	18.50	7.40	8.60	
8-NAR005.42	6/28/2006	S	.30	23.10	6.80	7.80	
8-NAR005.42	8/16/2006	S	.30	26.30	7.30	7.50	
8-NAR005.42	8/22/2006	S	.30				
8-NAR005.42	10/16/2006	S	.30	14.80	7.30	9.80	
8-NAR005.42	12/5/2006	S	.30	7.60	6.90	11.40	
8-NAR005.42	1/4/2007	S	.30	9.80	6.80	11.50	

Station ID	Collection Date	Depth Desc	Depth	Temp Celcius	Field Ph	Do Probe	Do Winkler
8-NAR005.42	3/8/2007	S	.30	7.30	6.20	11.20	
8-NAR005.42	3/20/2007	I	.00	10.30	6.40	10.30	
8-NAR005.42	4/11/2007	I	.00	10.40	6.70	10.60	
8-NAR005.42	4/16/2007	I	.00	11.90	6.60	10.20	
8-NAR005.42	5/8/2007	S	.30	15.60	6.80	8.80	
8-NAR005.42	5/16/2007	I	.00	21.30	6.90	7.90	
8-NAR005.42	5/30/2007	I	.00	23.00	6.80	7.20	
8-NAR005.42	6/28/2007	I	.00	28.40	7.00	7.00	
8-NAR005.42	7/9/2007	I	.00	27.10	6.90	7.40	
8-NAR005.42	7/12/2007	S	.30	30.30	5.50	4.80	
8-NAR005.42	8/6/2007	I	.00	26.40	7.10	6.50	
8-NAR005.42	9/5/2007	I	.00	22.50	7.00	7.90	
8-NAR005.42	9/11/2007	S	.30	26.20	7.20	7.40	
8-NAR005.42	10/9/2007	I	.00				
8-NAR005.42	10/9/2007	I	.00	23.40	7.40	10.00	
8-NAR005.42	10/25/2007	I	.00	16.80	6.60	7.70	
8-NAR005.42	10/29/2007	I	.00	12.10	6.80	9.70	
8-NAR005.42	11/5/2007	I	.00	10.90	6.90	10.50	
8-NAR005.42	11/5/2007	I	.00				
8-NAR005.42	11/7/2007	I	.00				
8-NAR005.42	11/26/2007	I	.00	8.00	6.90	10.60	
8-NAR005.42	11/27/2007	S	.30	12.10	6.70	10.60	
8-NAR005.42	1/7/2008	S	.30	7.10	6.30	12.00	
8-NAR005.42	1/10/2008	I	.00	7.20	7.10	11.80	
8-NAR005.42	1/29/2008	I	.00	2.60	7.10	13.20	
8-NAR005.42	1/29/2008	I	.00				
8-NAR005.42	2/3/2008	I	.00	4.20	7.00	11.90	
8-NAR005.42	2/26/2008	I	.00	7.10	7.20	12.60	
8-NAR005.42	3/4/2008	S	.30	12.50	6.50	11.80	
8-NAR005.42	3/6/2008	I	.00	11.20	6.90	11.20	
8-NAR005.42	3/9/2008	I	.00	7.90	6.90	11.20	
8-NAR005.42	3/12/2008	I	.00	8.40	6.80	12.00	
8-NAR005.42	3/27/2008	I	.00	13.60	7.00	10.50	
90th Percentile				**26.2**	**7.4**		
10th Percentile				**5.5**	**6.4**		

Sta Id	Collection Date Time	Depth Desc	Depth	Container I	Comment	00900 HARDNESS, TOTAL (MG/L AS CACO3) Value	Com Code
8-NAR005.42	01/25/1989 13:20	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	02/16/1989 13:10	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	03/09/1989 13:00	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	04/19/1989 13:30	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	05/16/1989 13:00	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	06/15/1989 13:50	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	08/14/1989 14:15	S	0.3	R	STORET DATA CONVERSION	20	
8-NAR005.42	09/14/1989 14:00	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	10/10/1989 13:30	S	0.3	R	STORET DATA CONVERSION	24	
8-NAR005.42	11/15/1989 13:15	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	12/14/1989 13:35	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	01/10/1990 12:45	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	02/07/1990 13:20	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	03/07/1990 12:30	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	04/12/1990 13:20	S	0.3	R	STORET DATA CONVERSION	30	
8-NAR005.42	05/15/1990 12:15	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	06/12/1990 12:50	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	07/17/1990 12:55	S	0.3	R	STORET DATA CONVERSION	22	
8-NAR005.42	09/17/1990 12:00	S	0.3	R	STORET DATA CONVERSION	26	
8-NAR005.42	10/15/1990 12:10	S	0.3	R	STORET DATA CONVERSION		
8-NAR005.42	11/28/1990 11:30	S	0.3	R	STORET DATA CONVERSION	26	
8-NAR005.42	12/17/1990 12:30	S	0.09	R	STORET DATA CONVERSION	22	
8-NAR005.42	01/15/1991 13:15	S	0.3	R	STORET DATA CONVERSION	24	
8-NAR005.42	02/05/1991 10:45	S	0.3	R	STORET DATA CONVERSION	20	
8-NAR005.42	03/13/1991 11:46	B	304.5	R	STORET DATA CONVERSION	22	
8-NAR005.42		S	0.09	R	STORET DATA CONVERSION	22	
8-NAR005.42	04/10/1991 13:20	S	0.09	R	STORET DATA CONVERSION	40	
8-NAR005.42	05/08/1991 10:25	S	0.09	R	STORET DATA CONVERSION	46	
8-NAR005.42	06/05/1991 13:20	S	0.3	R	STORET DATA CONVERSION	26	
8-NAR005.42	08/05/1991 10:52	S	0.3	R	STORET DATA CONVERSION	34	
8-NAR005.42	09/04/1991 11:40	S	0.3	R	STORET DATA CONVERSION	34	
8-NAR005.42	12/03/1991 11:31	S	0.3	R	STORET DATA CONVERSION	26	
8-NAR005.42	01/06/1992 11:20	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	02/18/1992 10:00	S	0.3	R	STORET DATA CONVERSION	24	
8-NAR005.42	03/04/1992 11:10	S	0.3	R	STORET DATA CONVERSION	24	
8-NAR005.42	04/13/1992 12:30	S	0.3	R	STORET DATA CONVERSION	20	
8-NAR005.42	05/11/1992 09:20	S	0.3	R	STORET DATA CONVERSION	26	
8-NAR005.42	06/10/1992 10:25	S	0.3	R	STORET DATA CONVERSION	32	
8-NAR005.42	07/07/1992 10:49	S	0.3	R	STORET DATA CONVERSION	28	
8-NAR005.42	08/17/1992 10:34	S	0.3	R	STORET DATA CONVERSION	22	
8-NAR005.42	09/02/1992 10:56	S	0.3	R	STORET DATA CONVERSION	2.6	
8-NAR005.42	10/01/1992 11:37	S	0.3	R	STORET DATA CONVERSION	43	
8-NAR005.42	11/03/1992 11:20	S	0.3	R	STORET DATA CONVERSION	34	
8-NAR005.42	12/02/1992 11:00	S	0.3	R	STORET DATA CONVERSION	19	
8-NAR005.42	01/05/1993 11:38	S	0.3	R	STORET DATA CONVERSION	21	
8-NAR005.42	02/01/1993 10:17	S	0.3	R	STORET DATA CONVERSION	28	
8-NAR005.42	03/03/1993 11:33	S	0.3	R	STORET DATA CONVERSION	24	
8-NAR005.42	04/05/1993 10:30	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	05/04/1993 09:30	S	0.3	R	STORET DATA CONVERSION	20	
8-NAR005.42	06/01/1993 11:35	S	0.3	R	STORET DATA CONVERSION	21	
8-NAR005.42	07/12/1993 11:00	S	0.3	R	STORET DATA CONVERSION	24	
8-NAR005.42	08/09/1993 10:30	S	0.3	R	STORET DATA CONVERSION	20	
8-NAR005.42	09/01/1993 11:10	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	10/07/1993 12:22	S	0.3	R	STORET DATA CONVERSION	26	
8-NAR005.42	11/02/1993 10:15	S	0.3	R	STORET DATA CONVERSION	38	
8-NAR005.42	12/20/1993 12:41	S	0.3	R	STORET DATA CONVERSION	20	
8-NAR005.42	01/31/1994 11:25	S	0.3	R	STORET DATA CONVERSION	14	
8-NAR005.42	02/10/1994 10:55	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	03/07/1994 12:44	S	0.3	R	STORET DATA CONVERSION	14	
8-NAR005.42	04/11/1994 12:34	S	0.3	R	STORET DATA CONVERSION	15	
8-NAR005.42	05/11/1994 11:00	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	06/08/1994 10:47	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	07/11/1994 11:00	S	0.3	R	STORET DATA CONVERSION	17	

Sta Id	Collection Date Time	Depth Desc	Depth	Container I	Comment	00900 HARDNESS, TOTAL (MG/L AS CACO3) Value	Com Code
8-NAR005.42	08/03/1994 12:11	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	09/12/1994 13:00	S	0.3	R	STORET DATA CONVERSION	26	
8-NAR005.42	10/11/1994 12:00	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	11/01/1994 11:00	S	0.3	R	STORET DATA CONVERSION	19	
8-NAR005.42	12/05/1994 10:00	S	0.3	R	STORET DATA CONVERSION	19	
8-NAR005.42	01/04/1995 12:22	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	02/01/1995 11:21	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	03/22/1995 09:14	S	0.3	R	STORET DATA CONVERSION	14	
8-NAR005.42	04/25/1995 13:20	S	0.3	R	STORET DATA CONVERSION	20	
8-NAR005.42	05/24/1995 12:30	S	0.3	R	STORET DATA CONVERSION	20	
8-NAR005.42	06/27/1995 08:00	S	0.3	R	STORET DATA CONVERSION	15	
8-NAR005.42	07/26/1995 11:35	S	0.3	R	STORET DATA CONVERSION	22	
8-NAR005.42	08/31/1995 11:40	S	0.3	R	STORET DATA CONVERSION	25	
8-NAR005.42	09/27/1995 11:00	S	0.3	R	STORET DATA CONVERSION	13	
8-NAR005.42	10/12/1995 10:45	S	0.3	R	STORET DATA CONVERSION	23	
8-NAR005.42	11/08/1995 10:00	S	0.3	R	STORET DATA CONVERSION	22	
8-NAR005.42	12/27/1995 10:00	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	01/31/1996 12:05	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	02/27/1996 10:20	S	0.3	R	STORET DATA CONVERSION	14	
8-NAR005.42	03/25/1996 09:45	S	0.3	R	STORET DATA CONVERSION	22	
8-NAR005.42	04/18/1996 12:30	S	0.3	R	STORET DATA CONVERSION	13	
8-NAR005.42	05/30/1996 11:30	S	0.3	R	STORET DATA CONVERSION	30	
8-NAR005.42	06/24/1996 09:00	S	0.3	R	STORET DATA CONVERSION	16	
8-NAR005.42	07/29/1996 10:30	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	08/26/1996 08:45	S	0.3	R	STORET DATA CONVERSION	20	
8-NAR005.42	09/24/1996 07:37	S	0.3	R	STORET DATA CONVERSION	21	
8-NAR005.42	10/29/1996 12:50	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	11/25/1996 10:00	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	12/19/1996 11:11	S	0.3	R	STORET DATA CONVERSION	15	
8-NAR005.42	01/27/1997 13:22	S	0.3	R	STORET DATA CONVERSION	15.6	
8-NAR005.42	02/13/1997 09:54	S	0.3	R	STORET DATA CONVERSION	16.9	
8-NAR005.42	03/17/1997 07:55	S	0.3	R	STORET DATA CONVERSION	18.5	
8-NAR005.42	04/09/1997 11:11	S	0.3	R	STORET DATA CONVERSION	20.7	
8-NAR005.42	05/05/1997 11:44	S	0.3	R	STORET DATA CONVERSION	20.7	
8-NAR005.42	06/02/1997 10:31	S	0.3	R	STORET DATA CONVERSION	22	
8-NAR005.42	07/02/1997 11:55	S	0.3	R	STORET DATA CONVERSION	15.7	
8-NAR005.42	08/04/1997 11:44	S	0.3	R	STORET DATA CONVERSION	19.8	
8-NAR005.42	09/25/1997 15:23	S	0.3	R	STORET DATA CONVERSION	19.1	
8-NAR005.42	10/22/1997 11:30	S	0.3	R	STORET DATA CONVERSION	16.4	
8-NAR005.42	11/12/1997 12:55	S	0.3	R	STORET DATA CONVERSION	13.3	
8-NAR005.42	12/08/1997 12:33	S	0.3	R	STORET DATA CONVERSION	21	
8-NAR005.42	01/12/1998 14:15	S	0.3	R	STORET DATA CONVERSION	48	
8-NAR005.42	02/12/1998 11:01	S	0.3	R	STORET DATA CONVERSION	13.8	
8-NAR005.42	03/12/1998 13:00	S	0.3	R	STORET DATA CONVERSION	18	
8-NAR005.42	04/13/1998 12:40	S	0.3	R	STORET DATA CONVERSION	13.1	
8-NAR005.42	05/05/1998 11:50	S	0.3	R	STORET DATA CONVERSION	14	
8-NAR005.42	06/01/1998 14:22	S	0.3	R	STORET DATA CONVERSION	19.6	
8-NAR005.42	07/06/1998 12:15	S	0.3	R	STORET DATA CONVERSION	13.8	
8-NAR005.42	08/19/1998 11:45	S	0.3	R	STORET DATA CONVERSION	13.7	
8-NAR005.42	09/15/1998 09:30	S	0.3	R	STORET DATA CONVERSION	11.8	
8-NAR005.42	10/06/1998 10:22	S	0.3	R	STORET DATA CONVERSION	10.7	
8-NAR005.42	11/03/1998 11:44	S	0.3	R	STORET DATA CONVERSION	14	
8-NAR005.42	12/14/1998 10:33	S	0.3	R	STORET DATA CONVERSION	19	
8-NAR005.42	01/12/1999 10:33	S	0.3	R		44	
8-NAR005.42	02/09/1999 11:11	S	0.3	R		26	
8-NAR005.42	03/16/1999 12:15	S	0.3	R		36	
8-NAR005.42	04/19/1999 10:55	S	0.3	R		18	
8-NAR005.42	05/19/1999 13:35	S	0.3	R		20	
8-NAR005.42	06/22/1999 14:00	S	0.3	R		13.3	
8-NAR005.42	07/01/1999 11:44	S	0.3	R		12.5	
8-NAR005.42	08/03/1999 10:31	S	0.3	R		14.3	
8-NAR005.42	09/01/1999 12:00	S	0.3	R		9.8	
8-NAR005.42	11/02/1999 12:30	S	0.3	R		18.3	

Sta Id	Collection Date Time	Depth Desc	Depth	Container I	Comment	00900 HARDNESS, TOTAL (MG/L AS CACO3) Value	Com Code
8-NAR005.42	12/28/1999 14:40	S	0.3	R		18.9	
8-NAR005.42	01/05/2000 15:20	S	0.3	R		25.5	
8-NAR005.42	02/03/2000 12:00	S	0.3	R		18.2	
8-NAR005.42	03/01/2000 13:00	S	0.3	R		13	
8-NAR005.42	04/12/2000 11:45	S	0.3	R		13	
8-NAR005.42	05/03/2000 12:30	S	0.3	R		15	
8-NAR005.42	06/07/2000 10:45	S	0.3	R		16	
8-NAR005.42	07/06/2000 10:40	S	0.3	R		16.3	
8-NAR005.42	08/08/2000 10:20	S	0.3	R	NORMAL FLOW	16.6	
8-NAR005.42	09/12/2000 10:30	S	0.3	R		17.5	
8-NAR005.42	10/16/2000 10:30	S	0.3	R	NORMAL FLOW	17.7	
8-NAR005.42	11/13/2000 10:30	S	0.3	R		16	
8-NAR005.42	01/16/2001 12:00	S	0.3	R		14.6	
8-NAR005.42	01/31/2001 13:00	S	0.3	R		17.2	
8-NAR005.42	03/12/2001 12:10	S	0.3	R		14.5	
8-NAR005.42	04/25/2001 12:05	S	0.3	R		5.7	
8-NAR005.42	06/11/2001 12:45	S	0.3	R		7.1	
8-NAR005.42	08/08/2001 16:00	S	0.3	R	LOW FLOW	16.3	
8-NAR005.42	10/04/2001 14:30	S	0.3	R	LOW FLOW	17.5	
8-NAR005.42	12/27/2001 11:00	S	0.3	R	BELOW NORMAL FLOW	7.2	
8-NAR005.42	02/05/2002 13:20	S	0.3	R	LOW FLOW	12.9	
8-NAR005.42	04/03/2002 13:00	S	0.3	R	NORMAL FLOW	18	
8-NAR005.42	06/26/2002 14:15	S	0.3	R	LOW FLOW	15	
8-NAR005.42	07/24/2002 11:40	S	0.3	R		44.5	
8-NAR005.42	11/13/2002 14:10	S	0.3	R		22.8	
8-NAR005.42	01/02/2003 14:10	S	0.3	R	ABOVE NORMAL FLOW	15.5	
8-NAR005.42	03/11/2003 10:45	S	0.3	R	NORMAL FLOW	20.3	
8-NAR005.42	07/10/2003 13:00	S	0.3	R	NORMAL FLOW	21.4	
8-NAR005.42	09/16/2003 13:20	S	0.3	R	NORMAL FLOW	17.7	
8-NAR005.42	11/13/2003 15:25	S	0.3	R	NORMAL FLOW.	16	
8-NAR005.42	01/21/2004 13:10	S	0.3	R	NORMAL FLOW; COMPLETELY FRI	19	
8-NAR005.42	04/19/2004 13:30	S	0.3	R		19.1	
8-NAR005.42	05/13/2004 12:15	S	0.3	R		16	
8-NAR005.42	07/13/2004 10:40	S	0.3	R	NORMAL FLOW.	18.5	
8-NAR005.42	08/12/2004 14:00	S	0.3	R	NORMAL FLOW; PH POST CALIBR/	17.5	
8-NAR005.42	09/16/2004 14:00	S	0.3	R	NORMAL FLOW.	14.7	
8-NAR005.42	10/05/2004 12:50	S	0.3	R		18.2	
8-NAR005.42	12/01/2004 10:40	S	0.3	R	NORMAL FLOW	16	
8-NAR005.42	12/21/2004 13:40	S	0.3	R		16	
8-NAR005.42	01/19/2005 10:40	S	0.3	R	ABOVE NORMAL FLOW.	15	
8-NAR005.42	02/08/2005 12:55	S	0.3	R	NORMAL FLOW	16	
8-NAR005.42	03/17/2005 11:00	S	0.3	R	NORMAL FLOW	16	
8-NAR005.42	04/21/2005 12:45	S	0.3	R		20.8	
8-NAR005.42	05/31/2005 11:20	S	0.3	R	NORMAL FLOW	16	
8-NAR005.42	06/06/2005 12:15	S	0.3	R	NORMAL FLOW	20	
8-NAR005.42	08/03/2005 11:10	S	0.3	R	LOW FLOW	20	
8-NAR005.42	08/17/2005 10:30	S	0.3	R	NORMAL FLOW	18	
8-NAR005.42	09/26/2005 12:20	S	0.3	R	LOW FLOW	18	
8-NAR005.42	10/13/2005 11:40	S	0.3	R	NORMAL FLOW	16	
8-NAR005.42	11/07/2005 11:05	S	0.3	R	NORMAL FLOW	18	
8-NAR005.42	12/08/2005 12:33	S	0.3	R	NORMAL FLOW	20	
8-NAR005.42	01/30/2006 11:00	S	0.3	R	NORMAL FLOW.	15	
8-NAR005.42	02/28/2006 12:54	S	0.3	R	BELOW NORMAL FLOW	15	
8-NAR005.42	03/23/2006 12:03	S	0.3	R	LOW FLOW	18	
8-NAR005.42	04/25/2006 12:10	S	0.3	R	NORMAL FLOW	15	
8-NAR005.42	06/28/2006 10:25	S	0.3	R	FLOOD STAGE	20	
8-NAR005.42	08/16/2006 12:30	S	0.3	R	VERY LOW FLOW	16	
8-NAR005.42	10/16/2006 14:00	S	0.3	R	NORMAL FLOW	18	
8-NAR005.42	12/05/2006 12:10	S	0.3	R	NORMAL FLOW	17	
8-NAR005.42	01/04/2007 14:30	S	0.3	R	ABOVE NORMAL FLOW.	15	
Mean						**19.4**	

Attachment 4

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Piedmont Regional Office
4949-A Cox Road Glen Allen, Virginia 23060

SUBJECT: Flow Frequency Determination / 303(d) Status
Doswell WWTF – VA0029521

TO: Ray Jenkins

FROM: Jennifer V. Palmore, P.G. JVP

DATE: April 7, 2008

COPIES: File

The Hanover County Doswell Wastewater Treatment Facility discharges to the North Anna River at the confluence of the Little River downstream of Hart Corner, VA. The rivermile for the discharge is 8-NAR003.55. Flow frequencies have been requested at this site for use in developing effluent limitations for the VPDES permit.

Previous flow frequencies were derived by using the flow frequencies for the gauge at the North Anna River at Hart Corner near Doswell, VA (#01671020), which is located at the Route 30 bridge approximately 2 miles upstream of the discharge, and then subtracting out the flow removed by several water withdrawals located between the gauge and the discharge. At the request of Hanover County, the USGS has installed a gauge on the North Anna directly upstream of the discharge (North Anna River at Little River, VA #01671025); the gauge has been in operation since July 2004. The flow measurements for the two gauges were correlated and were plotted on a logarithmic graph and a best fit power trend line was plotted through the data points.

Due to influence from the Lake Anna dam, only the period of record after 1979 was used to calculate the flow frequencies at the Route 30 gauge. The flow frequencies from the reference gage were plugged into the equation for the regression line to calculate the associated flow frequencies at the discharge point. The flow frequencies for the gauges are presented below. The regression analysis is attached.

North Anna River at Hart Corner near Doswell, VA (#01671020):
Drainage Area = 463 mi^2
Statistical period = 1979-2003
High Flow Months = Jan - May

1Q30 = 35 cfs	High Flow 1Q10 = 49 cfs
1Q10 = 36 cfs	High Flow 7Q10 = 52 cfs
7Q10 = 39 cfs	High Flow 30Q10 = 75 cfs
30Q10 = 42 cfs	HM = 111 cfs
30Q5 = 44 cfs	

North Anna River at Little River (#01671025):

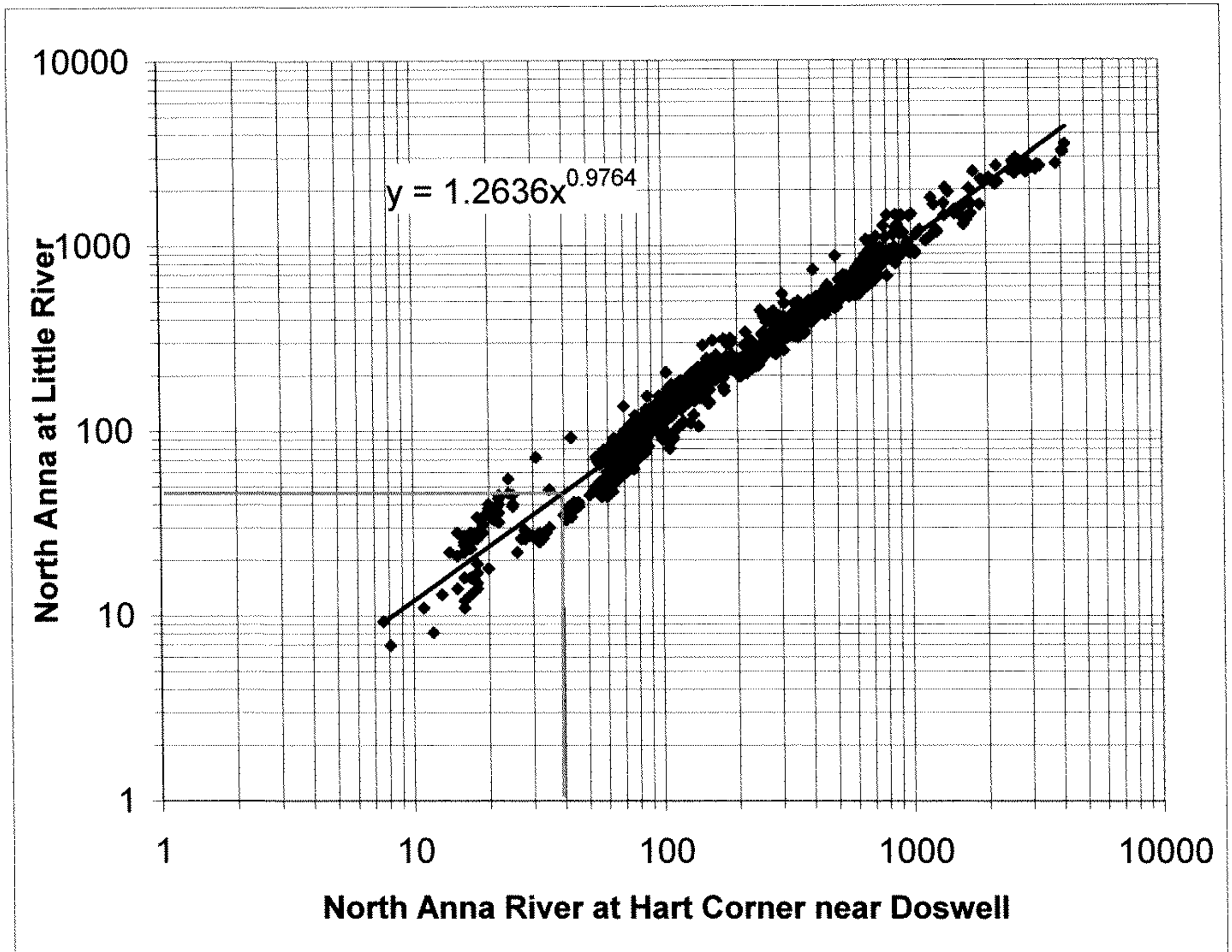
Drainage area = 467 mi^2

1Q30 = 41 cfs (26 MGD)	High Flow 1Q10 = 56 cfs (36 MGD)
1Q10 = 42 cfs (27 MGD)	High Flow 7Q10 = 60 cfs (39 MGD)
7Q10 = 45 cfs (29 MGD)	High Flow 30Q10 = 86 cfs (56 MGD)
30Q10 = 49 cfs (32 MGD)	HM = 126 cfs (81 MGD)
30Q5 = 51 cfs (33 MGD)	

The North Anna River at the discharge point was assessed as a Category 1 water during the 2006 305(b)/303(d) cycle. The river was considered fully supporting of all of its designated uses – Aquatic Life Use, Recreation, Fish Consumption, and Wildlife Use.

If you have any questions concerning this analysis, please let me know.

North Anna at Little River #01671025
vs North Anna River at Hart Corner near Doswell, VA #01671020



SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.975703111
R Square	0.951996561
Adjusted R Square	0.951961213
Standard Error	92.6009299
Observations	1360

Flow Frequencies (cfs)

@ Hart Corner		@ Little River
35	1Q30	41
36	1Q10	42
39	7Q10	45
42	30Q10	49
44	30Q5	51
49	HF 1Q10	56
52	HF 7Q10	60
75	HF 30Q10	86
111	HM	126
463	DA (mi^2)	467

HF Months: Jan-May
Period: 1979-2003

Attachment 5

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Wastewater Facility Inspection Report

Revised 08/2001

Facility Name:	Doswell WWTP	**Facility No.:**	VA0029521
~~City~~/County:	Hanover	**Inspection Agency:**	DEQ - PRO
Inspection Date:	September 20, 2007	**Date Form Completed:**	September 21, 2007
Inspector:	Mike Dare MDare 9.21-07	**Time Spent:**	8 hrs. w/ travel & report
Reviewed By:	CMWood 10/1/07	**Unannounced Insp.?**	No
		FY-Scheduled Insp.?	Yes

Present at Inspection: Barbara Mitchell, Gary Proffit

TYPE OF FACILITY:

Domestic		Industrial	
[ ] Federal	[X] Major	[ ] Major	[ ] Primary
[x] Non-Federal	[ ] Minor	[ ] Minor	[ ] Secondary

Population Served: approx.: Varies seasonally with the operation of Kings Dominion

Number of Connections: approx.: 8 – the amusement park, Bear Island Paper Co. sanitary sewer & local businesses

TYPE OF INSPECTION:

[x] Routine   Date of last inspection: January 27 & 31, 2005

[ ] Compliance   Agency: DEQ/PRO

[ ] Reinspection

INFLUENT and EFFLUENT MONITORING: **Please refer to the DMR file for Data**

Last month average: BOD: ___ mg/L   TSS: ___ mg/L   Flow: __ MGD
(Influent) Date:
Other: _________ mg/L

Last month: CBOD: ____ mg/L   TSS: ____ mg/L   Flow:___ MGD
(Effluent) Date:
Other:

Quarter average: CBOD: _____ mg/L   TSS: ____ mg/L   Flow: ___ MGD
(Effluent) Date:
Other:

CHANGES AND/OR CONSTRUCTION

DATA VERIFIED IN PREFACE	[ ] Updated	[x] No changes	
Has there been any new construction?	[ ] Yes*	[x] No	
If yes, were plans and specifications approved?	[ ] Yes	[ ] No*	[x] N/A
DEQ approval date:	N/A		

(A) PLANT OPERATION AND MAINTENANCE

1. Class and number of licensed operators: ***Class I – 4; Class II – 1***
2. Hours per day plant is staffed: ***13.5 hours/day, 7 days/week***
3. Describe adequacy of staffing: [ ] Good [ ] Average [x] Poor*
4. Does the plant have an established program for training personnel? [x] Yes [ ] No
5. Describe the adequacy of the training program: [x] Good [ ] Average [ ] Poor*
6. Are preventive maintenance tasks scheduled? [x] Yes [ ] No*
7. Describe the adequacy of maintenance: [ ] Good [x] Average [ ] Poor*
8. Does the plant experience any organic/hydraulic overloading? [ ] Yes* [x] No

   If yes, identify cause and impact on plant: ***Two 0.5 MG Equalization Basins limit impact of surges.***
9. Any bypassing since last inspection? [ ] Yes* [x] No
10. Is the on-site electric generator operational? [x] Yes [ ] No* [ ] N/A
11. Is the STP alarm system operational? [x] Yes [ ] No * [ ] N/A
12. How often is the standby generator exercised? [x] Weekly [ ] Monthly [ ] Other:

    Power Transfer Switch? [x] Weekly [ ] Monthly [ ] Other:

    Alarm System? [x] Weekly [ ] Monthly [ ]Other:
13. When were the cross connection control devices last tested on the potable water service? ***All four tested 10/3/06***
14. Is sludge disposed in accordance with the approved sludge disposal plan? [x] Yes [ ] No* [ ] N/A
15. Is septage received by the facility? [ ] Yes [x] No

    Is septage loading controlled? [ ] Yes [ ] No * [x] N/A

    Are records maintained? [ ] Yes [ ] No* [x] N/A
16. Overall appearance of facility: [ ] Good [x] Average [ ] Poor*

Comments: #1, 2 & 3) In 2000 the plant hours of operation were reduced from 24 hrs/day to 13.5 hrs/day, and the staffing was reduced, however the workload and tasks required to operate the plant did not change. The County Maintenance crew is now being called in to perform routine maintenance tasks. #4 The training program includes unit by unit OJT with the "Doswell WWTP Training Guide", VA Rural Water Assoc. training, Licensing Prep classes at John Tyler and DEQ Lab Workshops. #14 The approved plan calls for landfill disposal.

(B) PLANT RECORDS

1. Which of the following records does the plant maintain?

Operational Logs for each unit process	[x] Yes	[ ] No*	[ ] N/A
Instrument maintenance and calibration	[x] Yes	[ ] No*	[ ] N/A
Mechanical equipment maintenance	[x] Yes	[ ] No*	[ ] N/A
Industrial waste contribution **(Municipal Facilities)**	[ ] Yes	[ ] No*	[x] N/A

2. What does the operational log contain?

Visual Observations	[x] Yes	[ ] No	[ ] N/A
Flow Measurement	[x] Yes	[ ] No	[ ] N/A
Laboratory Results	[x] Yes	[ ] No	[ ] N/A
Process Adjustments	[x] Yes	[ ] No*	[ ] N/A
Control Calculations	[x] Yes	[ ] No	[ ] N/A
Other:			

3. What do the mechanical equipment records contain:

As built plans and specs?	[x] Yes	[ ] No*	[ ] N/A
Spare parts inventory?	[x] Yes	[ ] No*	[ ] N/A
Manufacturers instructions?	[x] Yes	[ ] No*	[ ] N/A
Equipment/parts suppliers?	[x] Yes	[ ] No*	[ ] N/A
Lubrication schedules?	[x] Yes	[ ] No*	[ ] N/A
Other:			
Comments:	None		

4. What do the industrial waste contribution records contain: ***(Applicable to municipal facilities only)***

Waste characteristics?	[ ] Yes	[ ] No*	[x] N/A
Locations and discharge types?	[ ] Yes	[ ] No*	[x] N/A
Impact on plant?	[ ] Yes	[ ] No*	[x] N/A
Other:	N/A		
Comments:	None		

5. Are the following records maintained at the plant:

Equipment maintenance records	[x] Yes	[ ] No*	[ ] N/A
Operational Log	[x] Yes	[ ] No*	[ ] N/A
Industrial contributor records	[ ] Yes	[ ] No*	[x] N/A
Instrumentation records	[x] Yes	[ ] No*	[ ] N/A
Sampling and testing records	[x] Yes	[ ] No*	[ ] N/A

6. Are records maintained at a different location? [ ] Yes [x] No
   Where are the records maintained? ***All are available on site, except some original P&S that are kept at the Courthouse***

7. Were the records reviewed during the inspection? [x] Yes [ ] No

8. Are the records adequate and the O & M Manual current? [x] Yes [ ] No* [ ] N/A
   O&M Manual date written: ***February 1999, upgrade Submitted August 2003***

   Date DEQ approved O&M ***VDH approval 8/18/99;***

9. Are the records maintained for required 3-year period? [x] Yes [ ] No*

Comments: #1. - A single operational log is kept for the entire plant. Log includes notes for various treatment units, observations, equipment adjustments and control tests. #2. - Lab records are separate from operational log.

(C) SAMPLING

1. Are sampling locations capable of providing representative samples? [x] Yes [ ] No* [ ] N/A
2. Do sample types correspond to those required by the permit? [x] Yes [ ] No* [ ] N/A
3. Do sampling frequencies correspond to those required by the permit? [x] Yes [ ] No* [ ] N/A
4. Are composite samples collected in proportion to flow? [x] Yes [ ] No* [ ] N/A
5. Are composite samples refrigerated during collection? [x] Yes [ ] No* [ ] N/A
6. Does plant maintain required records of sampling? [x] Yes [ ] No* [ ] N/A
7. Does plant run operational control tests? [x] Yes [ ] No* [ ] N/A

Comments: Please see attached operational control data.

(D) TESTING

1. Who performs the testing?
   [x] Plant/ Lab: ***BOD, TSS, pH, D.O.***
   [ ] Central Lab
   [x] Commercial Lab - Name: ***EnviroCompliance – Nutrients, Microbac – Fecals, Totopotomy WWTP Lab – Ortho/Total P***

If plant performs any testing, complete 2-4.

2. What method is used for chlorine analysis? ***N/A – UV disinfection***
3. Is sufficient equipment available to perform required tests? [x] Yes [ ] No* [ ] N/A
4. Does testing equipment appear to be clean and/or operable? [x] Yes [ ] No* [ ] N/A

Comments: Please see enclosed DEQ *Laboratory Inspection Report*.

(E) FOR INDUSTRIAL FACILITIES W/ TECHNOLOGY BASED LIMITS N/A

1. Is the production process as described in the permit application? (If no, describe changes in comments)
   [ ] Yes [ ] No* [x] N/A
2. Do products and production rates correspond to the permit application? (If no, list differences in comments section)
   [ ] Yes [ ] No* [x] N/A
3. Has the State been notified of the changes and their impact on plant effluent?
   [ ] Yes [ ] No* [x] N/A

Comments: None

FOLLOW UP TO COMPLIANCE RECOMMENDATIONS FROM THE January 27 & 31, 2005 DEQ INSPECTION:

1. There were no Compliance Recommendations.

FOLLOW UP TO GENERAL RECOMMENDATIONS FROM THE January 27 & 31, 2005 DEQ INSPECTION:

1. The intensity sensor on the UV light system is malfunctioning; always indicating low intensity, even with new bulbs. The manufacturer has not been able to resolve the problem. Currently bulb cleaning is scheduled for every other week. Based on fecal coliform monitoring, this frequency of cleaning is adequate to maintain sufficient intensity for disinfection. Discussing this matter with your DEQ Permit Writer, Ray Jenkins, is recommended. ***One bank of bulbs is cleaned each week, or sooner if fecal results spike. This procedure reportedly approved by Mr. Jenkins.***

2. Repair the aerator from the East EQ basin as soon as practical. The East basin was offline and currently not needed; generally only one of the 0.5 MG basins is required. ***Aerator has been repaired.***

3. Pump station debris is being applied to drying beds. In addition to raw sewage, which carries pathogens and attracts rodents, the solids removed from the pumping stations often contain a lot of grease which may clog the drainage system. The County staff should look at other options for providing a suitable receiving station for the vac-trucks. ***Most pump station debris now going to Totopotomy WWTP for dewatering and disposal.***

INSPECTION REPORT SUMMARY

Compliance Recommendations/Request for Corrective Action:

1. There are no compliance recommendations.

General Recommendations and Observations:

There are no General Recommendations.

Items evaluated during this inspection include (check all that apply):

[x] Yes	[ ] No		Operational Units
[ ] Yes	[x] No		O & M Manual
[x] Yes	[ ] No		Maintenance Records
[ ] Yes	[ ] No	[x] N/A	Pathogen Reduction & Vector Attraction Reduction
[ ] Yes	[x] No	[ ] N/A	Sludge Disposal Plan
[ ] Yes	[ ] No	[x] N/A	Groundwater Monitoring Plan
[ ] Yes	[ ] No	[x] N/A	Storm Water Pollution Prevention Plan
[x] Yes	[ ] No	[ ] N/A	Permit Special Conditions
[x] Yes	[ ] No	[ ] N/A	Permit Water Quality Chemical Monitoring
[x] Yes	[ ] No	[ ] N/A	Laboratory Records (see Lab Report)

DEPARTMENT OF ENVIRONMENTAL QUALITY - WATER DIVISION
LABORATORY INSPECTION REPORT

10/01

FACILITY NO:	INSPECTION DATE:	PREVIOUS INSP. DATE:	PREVIOUS EVALUATION:	TIME SPENT:
VA0029521	September 20, 2007	January 27, 2005	Deficiencies	8 hours w/ travel & report

NAME/ADDRESS OF FACILITY:	FACILITY CLASS:	FACILITY TYPE:	UNANNOUNCED INSPECTION? / FY-SCHEDULED INSPECTION?
Doswell Wastewater Treatment Plant P.O. Box 470 Hanover, VA 23069	(X) MAJOR ( ) MINOR ( ) SMALL ( ) VPA/NDC	(X) MUNICIPAL ( ) INDUSTRIAL ( ) FEDERAL ( ) COMMERCIAL LAB	**UNANNOUNCED INSPECTION?** ( ) YES (x) NO **FY-SCHEDULED INSPECTION?** (X) YES ( ) NO

INSPECTOR(S):	REVIEWERS:	PRESENT AT INSPECTION:
Mike Dare M Dare 9-21-07	CMWood 10/1/07	Barbara Mitchell

LABORATORY EVALUATION	DEFICIENCIES? Yes	No
LABORATORY RECORDS		x
GENERAL SAMPLING & ANALYSIS		x
LABORATORY EQUIPMENT		x
DISSOLVED OXYGEN ANALYSIS PROCEDURES		x
pH ANALYSIS PROCEDURES		x
BIOCHEMICAL OXYGEN DEMAND ANALYSIS PROCEDURES	x	
TOTAL SUSPENDED SOLIDS ANALYSIS PROCEDURES		x

QUALITY ASSURANCE/QUALITY CONTROL

Y/N	QUALITY ASSURANCE METHOD	PARAMETERS	FREQUENCY
Y	REPLICATE SAMPLES	BOD samples, Blanks, Seed Dilutions and TSS samples	Each weekly
	SPIKED SAMPLES		
Y	STANDARD SAMPLES	BOD - GGA	Weekly
	SPLIT SAMPLES		
Y	SAMPLE BLANKS	BOD	each series
	OTHER		
Y	EPA-DMR QA DATA?	RATING: (X) No Deficiency ( ) Deficiency ( ) NA	***Study 26***
	QC SAMPLES PROVIDED?	RATING: ( ) No Deficiency ( ) Deficiency (X) NA	

COPIES TO: (X) DEQ - RO; (X) OWPP; ( ) VDH- DWE; (X) OWNER; (X) EPA-Region III; ( ) Other:

FACILITY #: VA0029521

LABORATORY RECORDS SECTION

LABORATORY RECORDS INCLUDE THE FOLLOWING:

X	SAMPLING DATE	X	ANALYSIS DATE	X	CONT MONITORING CHART
X	SAMPLING TIME	X	ANALYSIS TIME	X	INSTRUMENT CALIBRATION
X	SAMPLE LOCATION	X	TEST METHOD	X	INSTRUMENT MAINTENANCE
				X	CERTIFICATE OF ANALYSIS

WRITTEN INSTRUCTIONS INCLUDE THE FOLLOWING:

X	SAMPLING SCHEDULES	X	CALCULATIONS	X	ANALYSIS PROCEDURES

	YES	NO	N/A
DO ALL ANALYSTS INITIAL THEIR WORK?	X		
DO BENCH SHEETS INCLUDE ALL INFORMATION NECESSARY TO DETERMINE RESULTS?	X		
IS THE DMR COMPLETE AND CORRECT? MONTH(S) REVIEWED: ***August 2007***	X		
ARE ALL MONITORING VALUES REQUIRED BY THE PERMIT REPORTED?	X		

GENERAL SAMPLING AND ANALYSIS SECTION

	YES	NO	N/A
ARE SAMPLE LOCATION(S) ACCORDING TO PERMIT REQUIREMENTS?	X		
ARE SAMPLE COLLECTION PROCEDURES APPROPRIATE?	X		
IS SAMPLE EQUIPMENT CONDITION ADEQUATE?	X		
IS FLOW MEASUREMENT ACCORDING TO PERMIT REQUIREMENTS?	X		
ARE COMPOSITE SAMPLES REPRESENTATIVE OF FLOW?	X		
ARE SAMPLE HOLDING TIMES AND PRESERVATION ADEQUATE?	X		
IF ANALYSIS IS PERFORMED AT ANOTHER LOCATION, ARE SHIPPING PROCEDURES ADEQUATE? LIST PARAMETERS AND NAME & ADDRESS OF LAB: ***Ammonia, TKN, Nitrate, Nitrite - EnviroCompliance Laboratories, Inc, Glen Allen, VA; Fecals – Microbac, Richmond, VA; Ortho/Total P – Totopotomy WWTP Lab.***	X		

LABORATORY EQUIPMENT SECTION

	YES	NO	N/A
IS LABORATORY EQUIPMENT IN PROPER OPERATING RANGE?	X		
ARE ANNUAL THERMOMETER CALIBRATION(S) ADEQUATE?	X		
IS THE LABORATORY GRADE WATER SUPPLY ADEQUATE?			X
ARE ANALYTICAL BALANCE(S) ADEQUATE?	X		

LABORATORY INSPECTION REPORT SUMMARY

FACILITY NAME:	FACILITY NO:	INSPECTION DATE:
Doswell WWTP	VA0029521	September 20, 2007

LABORATORY EVALUATION:	**(X) Deficiencies** **( ) No Deficiencies**

LABORATORY RECORDS

No Deficiencies – As allowed by the permit, Ms. Mitchell will begin including DMR data for any incomplete calendar week at months end in the following monthly reporting period.

GENERAL SAMPLING AND ANALYSIS

No Deficiencies

LABORATORY EQUIPMENT

No Deficiencies

INDIVIDUAL PARAMETERS

pH, Dissolved Oxygen, and Total Suspended Solids Analysis Procedures: No deficiencies

Biochemical Oxygen Demand Analysis Procedures:

1. Two of five seed corrections for period 7/29/07 to 8/2/07 are >1.0 mg/L. Data not flagged. Flag on bench sheet and DMR.

Attachment 6

Subsections this Attachment are identified as 6A, 6B, and 6C

Attachment 6A presents the results of water quality criteria monitoring on Outfall 001

Attachment 6B presents Discharge Monitoring Report (DMR) data for Outfall 001

Attachment 6C presents DMR data for Outfalls 101 and 102

Attachment 6A

Results of water quality criteria monitoring on Outfall 001

Attachment 6A

Items in bold face are considered to be present in the discharge and require evaluation. See Attachment 7 of this fact sheet. Dioxin was not tested at the required QL and is also addressed in Attachment 7.

Parameter	Required QL (µg/L)	February 28, 2007	May 23, 2007	July 25, 2007
METALS (µg/L)				
Antimony, dissolved	18000	<100	<100	<100
Arsenic, dissolved	210	<60	<60	<60
Cadmium, dissolved	3.1	<0.50	<0.50	<0.50
Chromium, dissolved	---	<10	<10	<10
Chromium III, dissolved	570			<10
Chromium VI, dissolved	9.2			<5.0
Copper, dissolved	30	**6**	**<5**	**<5**
Lead, dissolved [(A)]	44	**<20**	**<20**	**30**
Mercury, dissolved	1.0	<0.1	<0.1	<0.1
Nickel, dissolved	57	<10	<10	<10
Selenium, dissolved	10.0	<2	<2	<2
Silver, dissolved	11.0	<5	<5	<5
Thalium, dissolved	(B)	<40	<40	<40
Zinc, dissolved [(A)]	180	**108**	**101**	**134**
PESTICIDES / PCBs (µg/L)				
Aldrin	0.05			<0.05
Chlordane	0.2			<0.20
Chlorpyrifos	(B)			<0.10
DDD	0.1			<0.05
DDE	0.1			<0.05
DDT	0.1			<0.05
Demeton	(B)			<0.10
Dieldrin	0.1			<0.05
Alpha-Endosulfan	0.1			<0.05
Beta -Endosulfan	0.1			<0.05
Endosulfan sulfate	0.1			<0.05
Endrin	0.1			<0.05
Endrin Aldehyde	(B)			<0.05
Guthion	(B)			<0.10
Heptachlor	0.05			<0.05
Heptachlor Epoxide	(B)			<0.05
Alpha-BHC	(B)			<0.05
Beta-BHC	(B)			<0.05
Gamma-BHC or Lindane	0.05			<0.05
Kepone	(B)			<0.40
Malathion	(B)			<0.10
Methoxychlor	(B)			<0.05
Mirex	(B)			<0.05
Parathion	(B)			<0.10
PCB 1260	1.0			<1
PCB 1254	1.0			<1
PBC 1248	1.0			<1
PCB 1242	1.0			<1
PCB 1232	1.0			<1
PCB 1221	1.0			<1
PCB 1016	1.0			<1
PCB Total	7.0			<7
Toxaphene	5.0			<5.0
BASE NEUTRALS (µg/L)				
Acenapthene	10.0	<10.0	<10.0	<10.0
Anthracene	10.0	<10.0	<10.0	<10.0
Benzidine	(B)	<10.0	<10.0	<10.0
Benzo (a) anthracene	10.0	<10.0	<10.0	<10.0
Benzo (b) fluoranthene	10.0	<10.0	<10.0	<10.0
Benzo (k) fluoranthene	10.0	<10.0	<10.0	<10.0
Benzo (a) pyrene	10.0	<10.0	<10.0	<10.0
Bis 2-Chloroethyl Ether	(B)	<10.0	<10.0	<10.0
Bis 2-Chloroisopropyl Ether	(B)	<10.0	<10.0	<10.0
Butyl benzyl phthalate	10.0	<10.0	<10.0	<10.0
2-Chloronapthalene	(B)	<10.0	<10.0	<10.0
Chrysene	10.0	<10.0	<10.0	<10.0

Parameter	Required QL (µg/L)	February 28, 2007	May 23, 2007	July 25, 2007
Dibenz(a,h)anthracene	20.0	<10.0	<10.0	<10.0
Dibutyl phthalate	10.0	<10.0	<10.0	<10.0
1,2- Dichlorobenzene	10.0	<10.0		
1,3- Dichlorobenzene	10.0	<10.0		
1,4- Dichlorobenzene	10.0	<10.0		
3,3-Dichlorobenzidine	(B)	<10.0	<10.0	<10.0
Diethyl phthalate	10.0	<10.0	<10.0	<10.0
Di-2-Ethylhexyl Phthalate	10.0	<10.0	<10.0	<10.0
Dimethyl phthalate	(B)	<10.0	<10.0	<10.0
2,4-Dinitrotoluene	10.0	<10.0	<10.0	<10.0
1,2-Diphenylhydrazine	(B)	<10.0	<10.0	<10.0
Fluoranthene	10.0	<10.0	<10.0	<10.0
Fluorene	10.0	<10.0	<10.0	<10.0
Hexachlorobenzene	(B)	<10.0	<10.0	<10.0
Hexachlorobutadiene	(B)	<10.0	<10.0	<10.0
Hexachlorocyclopentadiene	(B)	<10.0	<10.0	<10.0
Hexachloroethane	(B)	<10.0	<10.0	<10.0
Indeno (1,2,3-cd) pyrene	20.0	<10.0	<10.0	<10.0
Isophorone	10.0	<10.0	<10.0	<10.0
Nitrobenzene	10.0	<10.0	<10.0	<10.0
N-Nitrosodimethylamine	(B)	<10.0	<10.0	<10.0
N-Nitrosodi-n-propylamine	(B)	<10.0	<10.0	<10.0
N-Nitrosodiphenylamine	(B)	<10.0	<10.0	<10.0
Pyrene	10.0	<10.0	<10.0	<10.0
1,2,4-Trichlorobenzene	10.0	<10.0	<10.0	<10.0
VOLATILES (µg/L)				
Acrolein	(B)	<10.0	<10.0	<10.0
Acrylonitrile	(B)	<10.0	<10.0	<10.0
Benzene	10.0	<10.0	<10.0	<10.0
Bromoform	10.0	<10.0	<10.0	<10.0
Carbon Tetrachloride	10.0	<10.0	<10.0	<10.0
Chlorobenzene	(B)	<10.0	<10.0	<10.0
Chlorodibromomethane	10.0	<10.0	<10.0	<10.0
Chloroform	10.0	<10.0	<10.0	<10.0
Dichloromethane	20.0	<10.0	<10.0	<10.0
Dichlorobromomethane	20.0	<10.0	<10.0	<10.0
1,2-Dichloroethane	10.0	<10.0	<10.0	<10.0
1,1-Dichloroethylene	10.0	<10.0	<10.0	<10.0
1,2-trans-dichloroethylene	(B)	<10.0	<10.0	<10.0
1,2-Dichloropropane	(B)	<10.0	<10.0	<10.0
1,3-Dichloropropene	(B)	<20.0	<20.0	<20.0
Ethylbenzene	10.0	<10.0	<10.0	<10.0
Methyl bromide	(B)	<10.0	<10.0	<10.0
1,1,2,2-Tetrachloroethane	(B)	<10.0	<10.0	<10.0
Tetrachloroethylene	10.0	<10.0	<10.0	<10.0
Toluene	10.0	<10.0	<10.0	<10.0
1,1,2-Trichloroethane	(B)	<10.0	<10.0	<10.0
Trichloroethylene	10.0	<10.0	<10.0	<10.0
Vinyl chloride	10.0	<10.0	<10.0	<10.0
RADIONUCLIDES				
Strontium 90 (pCi/L)	(B)	Sampling for radionuclides will be required by special condition in the permit to be reissued.		
Tritium (pCi/L)	(B)			
Beta Particle & Photon Activity (mrem/yr)	(B)			
Gross Alpha Particle Activity (pCI/L)	(B)			
ACIDS (µg/L)				
2-Chlorophenol	10.0	<10.0	<10.0	<10.0
2,4 Dichlorophenol	10.0	<10.0	<10.0	<10.0
2,4- Dimethylphenol	10.0	<10.0	<10.0	<10.0
2,4-Dinitrophenol	(B)	<20.0	<20.0	<10.0
2-Methyl-4,6-Dinitrophenol	(B)	<10.0	<20.0	<10.0
Pentachlorophenol	50.0	<10.0	<20.0	<10.0
Phenol	10.0	<10.0	<10.0	<10.0
2,4,6-Trichlorophenol	10.0	<10.0	<10.0	<10.0
MISCELLANEOUS (µg/L unless otherwise noted)				
Chlorides, mg/L	(B)			29

Parameter	Required QL (µg/L)	February 28, 2007	May 23, 2007	July 25, 2007
Total Residual Chlorine	100	See footnote (C) below		
Cyanide, Total [D]	10.0	**11**	**10**	**<10**
Dioxin	0.00001			<0.0000101
Hardness, mg/L	(B)	586	581	521
Hydrogen sulfide	(B)			<300 sulfide
Tributyltin	(B)			<0.030
Xylenes total	6.0			<6.00

(A) Additional Data:	Dissolved Lead	Dissolved Zinc
October 11, 2007	<20	218
October 12, 2007	<20	173
October 17, 2007	<20	98
October 18, 2007	<20	113
October 24, 2007	<20	110
October 25, 2007	<20	104
October 31, 2007	<20	109
December 19, 2007	---	204

(B) Any approved method in 40 CFR Part 136 if the parameter is addressed in 40 CFR Part 136.

(C) In March 2007, TRC concentrations of 0.19 mg/L, 0.41 mg/L, and 0.48 mg/L were determined in conjunction with WET testing on Outfall 001. These data are not considered representative of Outfall 001 as neither the Doswell treatment plant nor Bear Island use chlorine compounds. These results are thought to be due to test interferences.

(D) Additional Data from cyanide study. These data were used to modify the permit in October 2006 to remove cyanide limitations that were added to the permit at reissuance in May 2003.

March 1, 2004	7.64
March 8, 2004	10.1
March 15, 2004	10.1
March 22, 2004	15.3
March 31, 2004	9.52
April 5, 2004	13.2
April 12, 2004	14.8
April 19, 2004	8.20
April 26, 2004	8.20
May 3, 2004	11.1
May 10, 2004	10.4
May 17, 2004	8.2
May 24, 2004	16.9
January 3, 2005	<6
April 4, 2005	18.8
July 11, 2005	9.77
October 10, 2005	11.2

Attachment 6B

Discharge Monitoring Report (DMR) data for Outfall 001

Attachment 6B

Outfall 001 Effluent Data

Outfall 001 Effluent Data from Discharge Monitoring Reports

Sample frequency is once per day unless otherwise noted.

Date	BOD_5, mg/L		TSS, mg/L (3/W)		D.O., mg/L	TKN, mg/L (3/W)	Temperature, °F			pH, Standard Units		Ammonia, mg/L (1/M)
	Reported	Limitation	Reported	Limitation	Minimum	Weekly Average	Minimum	Average	Maximum	Minimum	Maximum	Monthly Average
	Monthly Averages											
2005												
July	8.3	40.9	17.6	47.0	6.7	7.50	80.6	86.3	93.2	7.3	7.8	3.30
August	15.8	43.7	23.3	46.5	6.5	10.48	82.4	87.3	91.4	7.4	7.8	0.40
September	6.7	43.5	17.0	47.8	6.6	4.92	73.4	84.6	89.6	7.5	7.9	0.60
October	5.0	48.2	14.5	48.2	7.4	4.24	68.0	77.9	87.8	7.3	7.7	0.30
November	6.0	49.2	16.8	49.2	7.8	4.79	64.4	72.0	80.6	7.2	7.8	0.60
December	10.5	49.5	19.1	49.4	8.1	2.74	60.8	66.8	78.8	7.1	7.6	<0.20
2006												
January	5.5	49.1	15.0	49.1	7.7	3.62	59.0	67.6	80.6	7.0	7.7	1.36
February	9.2	49.2	15.1	49.2	8.2	2.98	60.8	70.2	77.0	7.1	7.6	<0.20
March	7.0	49.3	15.4	49.4	7.4	5.72	66.2	71.6	80.6	7.2	7.9	<0.20
April	7.9	48.9	15.6	48.9	6.8	7.90	60.8	75.0	84.2	7.1	7.8	1.10
May	4.2	48.9	6.2	48.9	6.9	3.14	64.4	80.7	87.8	7.2	7.8	0.29
June	10.1	48.6	15.4	48.6	6.5	4.53	78.8	87.1	95.0	7.1	7.8	<0.20
July	11.8	47.7	13.4	47.8	6.5	4.05	84.6	89.8	93.2	7.1	7.7	0.20
August	12.4	47.8	16.8	47.8	6.5	4.34	84.2	91.9	96.8	7.3	7.6	0.50
September	10.6	48.5	16.9	48.6	6.6	3.74	75.2	84.8	95.0	7.0	7.9	<0.20
October	7.2	48.9	13.4	49.0	6.5	4.52	68.0	77.3	84.2	7.3	7.9	2.00
November	8.9	48.9	20.9	48.9	6.5	4.42	60.8	70.9	80.6	7.1	7.9	1.50
December	8.7	49.5	17.3	49.5	6.6	3.14	66.2	74.5	82.4	7.2	7.8	0.40
2007												
January	3.8	49.3	12.1	49.4	6.5	2.39	55.4	68.8	80.6	7.0	7.7	0.30
February	10.5	49.5	26.0	49.5	7.9	2.29	53.6	69.0	75.2	7.3	7.8	<0.20
March	7.1	49.2	18.2	49.3	7.7	3.76	57.2	70.3	82.4	7.3	7.9	<0.20
April	2.2	49.0	8.7	49.0	7.0	3.30	60.8	76.2	84.2	7.2	7.9	<0.20
May	5.9	49.0	8.0	49.1	6.9	2.59	78.8	83.8	91.4	7.4	7.8	0.40
June	12.4	48.3	15.5	48.5	6.9	3.55	80.6	86.2	91.4	7.1	7.8	0.20
July	4.4	47.7	15.3	47.7	7.1	2.56	78.8	85.7	89.6	7.3	7.8	0.40
August	3.8	47.8	12.9	47.9	6.7	4.21	80.6	86.9	89.6	7.6	7.9	<0.20
September	9.3	48.8	13.6	48.8	6.9	3.61	80.6	85.6	89.6	7.4	7.7	<0.20
October	3.3	48.5	10.3	48.6	6.8	5.37	71.6	78.2	84.2	7.4	7.8	1.40

Date	BOD$_5$, mg/L		TSS, mg/L (3/W)		D.O., mg/L	TKN, mg/L (3/W)	Temperature, °F			pH, Standard Units		Ammonia, mg/L (1/M)
	Reported	Limitation	Reported	Limitation	Minimum	Weekly Average	Minimum	Average	Maximum	Minimum	Maximum	Monthly Average
	Monthly Averages											
November	3.9	49.4	11.3	49.3	7.4	2.88	64.4	74.5	82.4	7.2	7.8	<0.20
December	10.2	49.5	26.1	49.5	7.4	5.09	68.0	72.4	78.8	7.5	7.9	0.70
2008												
January	12.9	49.4	23.2	49.4	7.7	6.33	60.8	70.5	80.6	7.1	7.8	0.50
February	9.7	49.4	24.8	49.5	7.6	4.36	66.2	71.9	78.8	7.2	7.8	<0.20
March	8.6	49.3	19.5	49.3	7.2	4.12	68.0	74.1	82.4	7.2	7.8	<0.20
April	8.1	49.1	23.3	49.1	7.1	3.63	69.8	77.4	84.2	7.3	7.9	<0.20
May	7.7	48.9	28.5	48.9	6.9	7.42	68.0	78.4	87.8	7.2	7.9	1.50
June	6.8	48.2	12.6	48.2	6.6	3.35	80.6	86.5	91.4	6.9	7.9	0.50
Average	8.0	48.4	16.7	48.7	7.1	4.38	69.5	78.1	85.7	7.2	7.8	0.84
Maximum	15.8	49.5	28.5	49.5	8.2	10.48	84.6	91.9	96.8	7.6	7.9	3.30
Minimum	2.2	40.9	6.2	46.5	6.5	2.29	53.6	66.8	75.2	6.9	7.6	0.20
						90th percentile	80.6	87.0	93.2	7.4	7.9	
						10th percentile	59.9	69.6	78.8	7.1	7.7	
							(See below for temperatures in °C)					
Effluent Limitation:		48.4		48.7	6.5	13.0		NL	NL	6.00	9.00	NL
Ratio (in %) of actual value to limitation (using average values above):												
		16.5		34.3	100	33.7				N/A	N/A	
Baseline		1 / Day		1 / Day	1 / Day	1 / Day				1 / Day	1 / Day	
Allowable reduction in monitoring frequency:												
		1 / Week		3 / Week	No reductiion	3 / Week				Not applicable		

	Temperature, °C		
	Minimum	Average	Maximum
Average	20.8	25.6	29.8
Maximum	29.2	33.3	36
Minimum	12	19.3	24
90th percentile	27	30.6	34
10th percentile	15.5	20.9	26

Attachment 6C

DMR data for Outfalls 101 and 102

Attachment 6C

	Outfall 101		Outfall 201	
Date	BOD_5, mg/L (5/W)	TSS, mg/L (3/W)	BOD_5, mg/L (5/W)	TSS, mg/L (3/W)
	Monthly Averages			
2005				
July	4.5	9.2	8.6	18.2
August	3.6	10.3	11.1	22.4
September	2.8	14.0	7.7	16.2
October	0.5	8.2	5.6	15.6
November	2.3	6.5	7.0	19.0
December	2.3	17.1	9.1	23.0
2006				
January	1.5	17.8	6.1	15.9
February	0.8	14.3	9.6	14.1
March	4.3	13.1	5.3	14.1
April	7.4	11.6	7.5	15.4
May	6.0	9.9	3.3	6.6
June	4.4	11.3	8.7	16.2
July	5.1	12.6	11.5	14.4
August	6.4	17.7	12.4	15.6
September	2.6	12.4	10.6	16.6
October	1.6	10.4	6.9	15.1
November	4.3	12.3	9.4	21.3
December	1.0	13.9	8.7	18.5
2007				
January	1.1	16.8	3.5	12.1
February	1.9	12.2	9.2	21.1
March	0.2	10.1	7.2	16.5
April	6.4	10.0	1.7	8.1
May	4.4	8.1	4.8	7.1
June	4.3	13.0	12.7	17.9
July	7.5	16.8	3.5	11.5
August	0.6	6.6	4.3	15.6
September	3.0	11.4	9.8	15.2
October	1.1	9.1	2.9	10.5
November	5.2	23.1	2.6	9.5
December	4.7	22.3	8.2	27.7
2008				
January	4.8	20.5	7.5	20.5
February	1.9	12.0	9.6	25.8
March	3.8	12.6	9.1	20.5
April	3.5	12.4	8.5	19.9
May	3.7	9.8	8.0	25.4
June	4.6	10.1	7.1	14.2
Average	3.4	12.8	7.5	16.6
Maximum	7.5	23.1	12.7	27.7
Minimum	0.2	6.5	1.7	6.6
Limitation	30	30	50	50
% of actual average versus limitation	11.3	42.7	15.0	33.2

Baseline monitoring	1 / Day	1 / Day	1 / Day	1 / Day
Allowable reduction in monitoring frequency:				
	1 / Week	3 / Week	1 / Week	3 / Week

Attachment 7

Effluent Limitation Development

Attachment 7

The data summarized in the following table were provided in the permit renewal application. The data are summarized in Attachment 6A.

If data were reported at less than a quantification level (QL) equal to or less than the required QL, the parameter was considered absent for the purpose of this evaluation. All uncensored values (that is, not a "less than" value) were evaluated in regard to the need for a water quality based effluent limitation. The parameters requiring evaluation, which are indicated in bold type in the following table are ammonia (see Attachment 6B for effluent ammonia data), copper, lead, zinc, chloride, chlorine, and cyanide.

Included in this attachment are:

a. "Mixing Zone Predictions…". This analysis uses statistical flows and basic information about the receiving stream to predict mixing patterns in-stream.

   These pages (and others) are identified in the first line as either "existing" or "expansion". The "existing" condition uses an effluent flow of 5.8 MGD. The "expansion" condition uses and effluent flow of 6.34 MGD.

b. Spreadsheets titled "Water Quality Standards and Wasteload Allocations" (also known as MSTRANTI). These spreadsheets calculate the water quality standards and wasteload allocations given inputs for effluent and stream flow, pH, temperature, and hardness, and other stream characteristics. See Attachment 3 for stream data.

c. Calculation sheets ("STATS") that present a reasonable potential analysis of the listed data to determine if a water quality based effluent limitation is needed. The wasteload allocations from MSTRANTI are used in these analyses.

d. The following table shows a comparison of reported data to applicable human health wasteload allocations. No limitations are required to protect human health.

Parameter	**Outfall 001**	
	Expected Value*	WLA_{hh}**
Cyanide (µg/L)	10.5	1,300,000
Dissolved Zinc (µg/L)	133.9	430,000
Dioxin*** (ppq)	10.1	49

* See STATS printouts in this attachment.

** Taken from the MSTRANTI spreadsheet for the expansion flow (see Attachment 14), which is conservative for the existing condition.

*** The required QL for the dioxin testing was 10 ppq. Dioxin was reported as < 10.1 ppq. Dioxin is associated with the production of Kraft paper using chlorine. Bear Island is not a Kraft mill and no Kraft paper is presently used at the mill (although Special Condition 12 acknowledges that up to 10% purchased Kraft could be imported). The reported result of < 10.1 ppq is therefore, a reasonable indication that dioxin can be considered absent in this effluent. As presented in the table above however, if dioxin was present at a concentration of 10.1 ppq, a limitation would not be needed. Note that the dioxin standard applies at the mean annual stream flow. The annual mean for Water Years 1980 through 2007 is 387 cfs (250 MGD). The above WLA_{HH} was obtained using the MSTRANTI spreadsheet with an effluent flow of 6.34 MGD and stream flow of 250 MGD.

Mixing Zone Predictions for Doswell WWTP existing

Effluent Flow = 5.8 MGD
Stream 7Q10 = 29 MGD
Stream 30Q10 = 32 MGD
Stream 1Q10 = 27 MGD
Stream slope = 0.00038 ft/ft
Stream width = 75 ft
Bottom scale = 2
Channel scale = 1

Mixing Zone Predictions @ 7Q10

Depth = 1.5301 ft
Length = 5044.68 ft
Velocity = .4694 ft/sec
Residence Time = .1244 days

Recommendation:

A complete mix assumption is appropriate for this situation and the entire 7Q10 may be used.

Mixing Zone Predictions @ 30Q10

Depth = 1.6092 ft
Length = 4830.64 ft
Velocity = .4848 ft/sec
Residence Time = .1153 days

Recommendation:

A complete mix assumption is appropriate for this situation and the entire 30Q10 may be used.

Mixing Zone Predictions @ 1Q10

Depth = 1.4758 ft
Length = 5203.82 ft
Velocity = .4587 ft/sec
Residence Time = 3.1514 hours

Recommendation:

A complete mix assumption is appropriate for this situation providing no more than 31.73% of the 1Q10 is used.

FRESHWATER
WATER QUALITY CRITERIA / WASTELOAD ALLOCATION ANALYSIS

Facility Name: Doswell WWTP existing Permit No.: VA0029521

Receiving Stream: North Anna River Version: OWP Guidance Memo 00-2011 (8/24/00)

Stream Information		Stream Flows		Mixing Information		Effluent Information	
Mean Hardness (as CaCO3) =	19.4 mg/L	1Q10 (Annual) =	27 MGD	Annual - 1Q10 Mix =	31.73 %	Mean Hardness (as CaCO3) =	562 mg/L
90% Temperature (Annual) =	26.2 deg C	7Q10 (Annual) =	29 MGD	- 7Q10 Mix =	100 %	90% Temp (Annual) =	30.6 deg C
90% Temperature (Wet season) =	deg C	30Q10 (Annual) =	32 MGD	- 30Q10 Mix =	100 %	90% Temp (Wet season) =	deg C
90% Maximum pH =	7.4 SU	1Q10 (Wet season) =	0 MGD	Wet Season - 1Q10 Mix =	%	90% Maximum pH =	7.9 SU
10% Maximum pH =	6.4 SU	30Q10 (Wet season)	0 MGD	- 30Q10 Mix =	%	10% Maximum pH =	7.7 SU
Tier Designation (1 or 2) =	1	30Q5 =	33 MGD			Discharge Flow =	5.8 MGD
Public Water Supply (PWS) Y/N? =	n	Harmonic Mean =	81 MGD				
Trout Present Y/N? =	n	Annual Average =	MGD				
Early Life Stages Present Y/N? =	y						

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				Most Limiting Allocations			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH
Acenapthene	0	--	--	na	2.7E+03	--	--	na	1.8E+04	--	--	--	--	--	--	--	--	--	--	na	1.8E+04
Acrolein	0	--	--	na	7.8E+02	--	--	na	5.2E+03	--	--	--	--	--	--	--	--	--	--	na	5.2E+03
Acrylonitrile[C]	0	--	--	na	6.6E+00	--	--	na	9.9E+01	--	--	--	--	--	--	--	--	--	--	na	9.9E+01
Aldrin [C]	0	3.0E+00	--	na	1.4E-03	7.4E+00	--	na	2.1E-02	--	--	--	--	--	--	--	--	7.4E+00	--	na	2.1E-02
Ammonia-N (mg/l) (Yearly)	0	1.87E+01	2.06E+00	na	--	4.6E+01	1.3E+01	na	--	--	--	--	--	--	--	--	--	4.6E+01	1.3E+01	na	--
Ammonia-N (mg/l) (High Flow)	0	1.01E+01	2.80E+00	na	--	1.0E+01	2.8E+00	na	--	--	--	--	--	--	--	--	--	1.0E+01	2.8E+00	na	--
Anthracene	0	--	--	na	1.1E+05	--	--	na	7.4E+05	--	--	--	--	--	--	--	--	--	--	na	7.4E+05
Antimony	0	--	--	na	4.3E+03	--	--	na	2.9E+04	--	--	--	--	--	--	--	--	--	--	na	2.9E+04
Arsenic	0	3.4E+02	1.5E+02	na	--	8.4E+02	9.0E+02	na	--	--	--	--	--	--	--	--	--	8.4E+02	9.0E+02	na	--
Barium	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Benzene [C]	0	--	--	na	7.1E+02	--	--	na	1.1E+04	--	--	--	--	--	--	--	--	--	--	na	1.1E+04
Benzidine[C]	0	--	--	na	5.4E-03	--	--	na	8.1E-02	--	--	--	--	--	--	--	--	--	--	na	8.1E-02
Benzo (a) anthracene [C]	0	--	--	na	4.9E-01	--	--	na	7.3E+00	--	--	--	--	--	--	--	--	--	--	na	7.3E+00
Benzo (b) fluoranthene [C]	0	--	--	na	4.9E-01	--	--	na	7.3E+00	--	--	--	--	--	--	--	--	--	--	na	7.3E+00
Benzo (k) fluoranthene [C]	0	--	--	na	4.9E-01	--	--	na	7.3E+00	--	--	--	--	--	--	--	--	--	--	na	7.3E+00
Benzo (a) pyrene [C]	0	--	--	na	4.9E-01	--	--	na	7.3E+00	--	--	--	--	--	--	--	--	--	--	na	7.3E+00
Bis2-Chloroethyl Ether	0	--	--	na	1.4E+01	--	--	na	9.4E+01	--	--	--	--	--	--	--	--	--	--	na	9.4E+01
Bis2-Chloroisopropyl Ether	0	--	--	na	1.7E+05	--	--	na	1.1E+06	--	--	--	--	--	--	--	--	--	--	na	1.1E+06
Bromoform [C]	0	--	--	na	3.6E+03	--	--	na	5.4E+04	--	--	--	--	--	--	--	--	--	--	na	5.4E+04
Butylbenzylphthalate	0	--	--	na	5.2E+03	--	--	na	3.5E+04	--	--	--	--	--	--	--	--	--	--	na	3.5E+04
Cadmium	0	1.0E+01	1.2E+00	na	--	2.6E+01	7.3E+00	na	--	--	--	--	--	--	--	--	--	2.6E+01	7.3E+00	na	--
Carbon Tetrachloride [C]	0	--	--	na	4.4E+01	--	--	na	6.6E+02	--	--	--	--	--	--	--	--	--	--	na	6.6E+02
Chlordane [C]	0	2.4E+00	4.3E-03	na	2.2E-02	5.9E+00	2.6E-02	na	3.3E-01	--	--	--	--	--	--	--	--	5.9E+00	2.6E-02	na	3.3E-01
Chloride	0	8.6E+05	2.3E+05	na	--	2.1E+06	1.4E+06	na	--	--	--	--	--	--	--	--	--	2.1E+06	1.4E+06	na	--
TRC	0	1.9E+01	1.1E+01	na	--	4.7E+01	6.6E+01	na	--	--	--	--	--	--	--	--	--	4.7E+01	6.6E+01	na	--
Chlorobenzene	0	--	--	na	2.1E+04	--	--	na	1.4E+05	--	--	--	--	--	--	--	--	--	--	na	1.4E+05

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				Most Limiting Allocations			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH
Chlorodibromomethane[C]	0	--	--	na	3.4E+02	--	--	na	5.1E+03	--	--	--	--	--	--	--	--	--	--	na	5.1E+03
Chloroform [C]	0	--	--	na	2.9E+04	--	--	na	4.3E+05	--	--	--	--	--	--	--	--	--	--	na	4.3E+05
2-Chloronaphthalene	0	--	--	na	4.3E+03	--	--	na	2.9E+04	--	--	--	--	--	--	--	--	--	--	na	2.9E+04
2-Chlorophenol	0	--	--	na	4.0E+02	--	--	na	2.7E+03	--	--	--	--	--	--	--	--	--	--	na	2.7E+03
Chlorpyrifos	0	8.3E-02	4.1E-02	na	--	2.1E-01	2.5E-01	na	--	--	--	--	--	--	--	--	--	2.1E-01	2.5E-01	na	--
Chromium III	0	1.2E+03	8.0E+01	na	--	2.9E+03	4.8E+02	na	--	--	--	--	--	--	--	--	--	2.9E+03	4.8E+02	na	--
Chromium VI	0	1.6E+01	1.1E+01	na	--	4.0E+01	6.6E+01	na	--	--	--	--	--	--	--	--	--	4.0E+01	6.6E+01	na	--
Chromium, Total	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Chrysene [C]	0	--	--	na	4.9E-01	--	--	na	7.3E+00	--	--	--	--	--	--	--	--	--	--	na	7.3E+00
Copper	0	3.0E+01	9.7E+00	na	--	7.5E+01	5.8E+01	na	--	--	--	--	--	--	--	--	--	7.5E+01	5.8E+01	na	--
Cyanide	0	2.2E+01	5.2E+00	na	2.2E+05	5.4E+01	3.1E+01	na	1.4E+06	--	--	--	--	--	--	--	--	5.4E+01	3.1E+01	na	1.4E+06
DDD [C]	0	--	--	na	8.4E-03	--	--	na	1.3E-01	--	--	--	--	--	--	--	--	--	--	na	1.3E-01
DDE [C]	0	--	--	na	5.9E-03	--	--	na	8.8E-02	--	--	--	--	--	--	--	--	--	--	na	8.8E-02
DDT [C]	0	1.1E+00	1.0E-03	na	5.9E-03	2.7E+00	6.0E-03	na	8.8E-02	--	--	--	--	--	--	--	--	2.7E+00	6.0E-03	na	8.8E-02
Demeton	0	--	1.0E-01	na	--	--	6.0E-01	na	--	--	--	--	--	--	--	--	--	--	6.0E-01	na	--
Dibenz(a,h)anthracene [C]	0	--	--	na	4.9E-01	--	--	na	7.3E+00	--	--	--	--	--	--	--	--	--	--	na	7.3E+00
Dibutyl phthalate	0	--	--	na	1.2E+04	--	--	na	8.0E+04	--	--	--	--	--	--	--	--	--	--	na	8.0E+04
Dichloromethane (Methylene Chloride) [C]	0	--	--	na	1.6E+04	--	--	na	2.4E+05	--	--	--	--	--	--	--	--	--	--	na	2.4E+05
1,2-Dichlorobenzene	0	--	--	na	1.7E+04	--	--	na	1.1E+05	--	--	--	--	--	--	--	--	--	--	na	1.1E+05
1,3-Dichlorobenzene	0	--	--	na	2.6E+03	--	--	na	1.7E+04	--	--	--	--	--	--	--	--	--	--	na	1.7E+04
1,4-Dichlorobenzene	0	--	--	na	2.6E+03	--	--	na	1.7E+04	--	--	--	--	--	--	--	--	--	--	na	1.7E+04
3,3-Dichlorobenzidine[C]	0	--	--	na	7.7E-01	--	--	na	1.2E+01	--	--	--	--	--	--	--	--	--	--	na	1.2E+01
Dichlorobromomethane [C]	0	--	--	na	4.6E+02	--	--	na	6.9E+03	--	--	--	--	--	--	--	--	--	--	na	6.9E+03
1,2-Dichloroethane [C]	0	--	--	na	9.9E+02	--	--	na	1.5E+04	--	--	--	--	--	--	--	--	--	--	na	1.5E+04
1,1-Dichloroethylene	0	--	--	na	1.7E+04	--	--	na	1.1E+05	--	--	--	--	--	--	--	--	--	--	na	1.1E+05
1,2-trans-dichloroethylene	0	--	--	na	1.4E+05	--	--	na	9.4E+05	--	--	--	--	--	--	--	--	--	--	na	9.4E+05
2,4-Dichlorophenol	0	--	--	na	7.9E+02	--	--	na	5.3E+03	--	--	--	--	--	--	--	--	--	--	na	5.3E+03
2,4-Dichlorophenoxy acetic acid (2,4-D)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
1,2-Dichloropropane[C]	0	--	--	na	3.9E+02	--	--	na	5.8E+03	--	--	--	--	--	--	--	--	--	--	na	5.8E+03
1,3-Dichloropropene	0	--	--	na	1.7E+03	--	--	na	1.1E+04	--	--	--	--	--	--	--	--	--	--	na	1.1E+04
Dieldrin [C]	0	2.4E-01	5.6E-02	na	1.4E-03	5.9E-01	3.4E-01	na	2.1E-02	--	--	--	--	--	--	--	--	5.9E-01	3.4E-01	na	2.1E-02
Diethyl Phthalate	0	--	--	na	1.2E+05	--	--	na	8.0E+05	--	--	--	--	--	--	--	--	--	--	na	8.0E+05
Di-2-Ethylhexyl Phthalate [C]	0	--	--	na	5.9E+01	--	--	na	8.8E+02	--	--	--	--	--	--	--	--	--	--	na	8.8E+02
2,4-Dimethylphenol	0	--	--	na	2.3E+03	--	--	na	1.5E+04	--	--	--	--	--	--	--	--	--	--	na	1.5E+04
Dimethyl Phthalate	0	--	--	na	2.9E+06	--	--	na	1.9E+07	--	--	--	--	--	--	--	--	--	--	na	1.9E+07
Di-n-Butyl Phthalate	0	--	--	na	1.2E+04	--	--	na	8.0E+04	--	--	--	--	--	--	--	--	--	--	na	8.0E+04
2,4 Dinitrophenol	0	--	--	na	1.4E+04	--	--	na	9.4E+04	--	--	--	--	--	--	--	--	--	--	na	9.4E+04
2-Methyl-4,6-Dinitrophenol	0	--	--	na	7.65E+02	--	--	na	5.1E+03	--	--	--	--	--	--	--	--	--	--	na	5.1E+03
2,4-Dinitrotoluene [C]	0	--	--	na	9.1E+01	--	--	na	1.4E+03	--	--	--	--	--	--	--	--	--	--	na	1.4E+03
Dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin) (ppq)	0	--	--	na	1.2E-06	--	--	na	na	--	--	--	--	--	--	--	--	--	--	na	na
1,2-Diphenylhydrazine[C]	0	--	--	na	5.4E+00	--	--	na	8.1E+01	--	--	--	--	--	--	--	--	--	--	na	8.1E+01
Alpha-Endosulfan	0	2.2E-01	5.6E-02	na	2.4E+02	5.4E-01	3.4E-01	na	1.6E+03	--	--	--	--	--	--	--	--	5.4E-01	3.4E-01	na	1.6E+03
Beta-Endosulfan	0	2.2E-01	5.6E-02	na	2.4E+02	5.4E-01	3.4E-01	na	1.6E+03	--	--	--	--	--	--	--	--	5.4E-01	3.4E-01	na	1.6E+03
Endosulfan Sulfate	0	--	--	na	2.4E+02	--	--	na	1.6E+03	--	--	--	--	--	--	--	--	--	--	na	1.6E+03
Endrin	0	8.6E-02	3.6E-02	na	8.1E-01	2.1E-01	2.2E-01	na	5.4E+00	--	--	--	--	--	--	--	--	2.1E-01	2.2E-01	na	5.4E+00
Endrin Aldehyde	0	--	--	na	8.1E-01	--	--	na	5.4E+00	--	--	--	--	--	--	--	--	--	--	na	5.4E+00

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				Most Limiting Allocations			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH
Ethylbenzene	0	--	--	na	2.9E+04	--	--	na	1.9E+05	--	--	--	--	--	--	--	--	--	--	na	1.9E+05
Fluoranthene	0	--	--	na	3.7E+02	--	--	na	2.5E+03	--	--	--	--	--	--	--	--	--	--	na	2.5E+03
Fluorene	0	--	--	na	1.4E+04	--	--	na	9.4E+04	--	--	--	--	--	--	--	--	--	--	na	9.4E+04
Foaming Agents	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Guthion	0	--	1.0E-02	na	--	--	6.0E-02	na	--	--	--	--	--	--	--	--	--	--	6.0E-02	na	--
Heptachlor [C]	0	5.2E-01	3.8E-03	na	2.1E-03	1.3E+00	2.3E-02	na	3.1E-02	--	--	--	--	--	--	--	--	1.3E+00	2.3E-02	na	3.1E-02
Heptachlor Epoxide[C]	0	5.2E-01	3.8E-03	na	1.1E-03	1.3E+00	2.3E-02	na	1.6E-02	--	--	--	--	--	--	--	--	1.3E+00	2.3E-02	na	1.6E-02
Hexachlorobenzene[C]	0	--	--	na	7.7E-03	--	--	na	1.2E-01	--	--	--	--	--	--	--	--	--	--	na	1.2E-01
Hexachlorobutadiene[C]	0	--	--	na	5.0E+02	--	--	na	7.5E+03	--	--	--	--	--	--	--	--	--	--	na	7.5E+03
Hexachlorocyclohexane Alpha-BHC[C]	0	--	--	na	1.3E-01	--	--	na	1.9E+00	--	--	--	--	--	--	--	--	--	--	na	1.9E+00
Hexachlorocyclohexane Beta-BHC[C]	0	--	--	na	4.6E-01	--	--	na	6.9E+00	--	--	--	--	--	--	--	--	--	--	na	6.9E+00
Hexachlorocyclohexane Gamma-BHC[C] (Lindane)	0	9.5E-01	na	na	6.3E-01	2.4E+00	--	na	9.4E+00	--	--	--	--	--	--	--	--	2.4E+00	--	na	9.4E+00
Hexachlorocyclopentadiene	0	--	--	na	1.7E+04	--	--	na	1.1E+05	--	--	--	--	--	--	--	--	--	--	na	1.1E+05
Hexachloroethane[C]	0	--	--	na	8.9E+01	--	--	na	1.3E+03	--	--	--	--	--	--	--	--	--	--	na	1.3E+03
Hydrogen Sulfide	0	--	2.0E+00	na	--	--	1.2E+01	na	--	--	--	--	--	--	--	--	--	--	1.2E+01	na	--
Indeno (1,2,3-cd) pyrene [C]	0	--	--	na	4.9E-01	--	--	na	7.3E+00	--	--	--	--	--	--	--	--	--	--	na	7.3E+00
Iron	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Isophorone[C]	0	--	--	na	2.6E+04	--	--	na	3.9E+05	--	--	--	--	--	--	--	--	--	--	na	3.9E+05
Kepone	0	--	0.0E+00	na	--	--	0.0E+00	na	--	--	--	--	--	--	--	--	--	--	0.0E+00	na	--
Lead	0	3.6E+02	1.5E+01	na	--	8.9E+02	9.1E+01	na	--	--	--	--	--	--	--	--	--	8.9E+02	9.1E+01	na	--
Malathion	0	--	1.0E-01	na	--	--	6.0E-01	na	--	--	--	--	--	--	--	--	--	--	6.0E-01	na	--
Manganese	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Mercury	0	1.4E+00	7.7E-01	na	5.1E-02	3.5E+00	4.6E+00	na	3.4E-01	--	--	--	--	--	--	--	--	3.5E+00	4.6E+00	na	3.4E-01
Methyl Bromide	0	--	--	na	4.0E+03	--	--	na	2.7E+04	--	--	--	--	--	--	--	--	--	--	na	2.7E+04
Methoxychlor	0	--	3.0E-02	na	--	--	1.8E-01	na	--	--	--	--	--	--	--	--	--	--	1.8E-01	na	--
Mirex	0	--	0.0E+00	na	--	--	0.0E+00	na	--	--	--	--	--	--	--	--	--	--	0.0E+00	na	--
Monochlorobenzene	0	--	--	na	2.1E+04	--	--	na	1.4E+05	--	--	--	--	--	--	--	--	--	--	na	1.4E+05
Nickel	0	3.8E+02	2.2E+01	na	4.6E+03	9.4E+02	1.3E+02	na	3.1E+04	--	--	--	--	--	--	--	--	9.4E+02	1.3E+02	na	3.1E+04
Nitrate (as N)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Nitrobenzene	0	--	--	na	1.9E+03	--	--	na	1.3E+04	--	--	--	--	--	--	--	--	--	--	na	1.3E+04
N-Nitrosodimethylamine[C]	0	--	--	na	8.1E+01	--	--	na	1.2E+03	--	--	--	--	--	--	--	--	--	--	na	1.2E+03
N-Nitrosodiphenylamine[C]	0	--	--	na	1.6E+02	--	--	na	2.4E+03	--	--	--	--	--	--	--	--	--	--	na	2.4E+03
N-Nitrosodi-n-propylamine[C]	0	--	--	na	1.4E+01	--	--	na	2.1E+02	--	--	--	--	--	--	--	--	--	--	na	2.1E+02
Parathion	0	6.5E-02	1.3E-02	na	--	1.6E-01	7.8E-02	na	--	--	--	--	--	--	--	--	--	1.6E-01	7.8E-02	na	--
PCB-1016	0	--	1.4E-02	na	--	--	8.4E-02	na	--	--	--	--	--	--	--	--	--	--	8.4E-02	na	--
PCB-1221	0	--	1.4E-02	na	--	--	8.4E-02	na	--	--	--	--	--	--	--	--	--	--	8.4E-02	na	--
PCB-1232	0	--	1.4E-02	na	--	--	8.4E-02	na	--	--	--	--	--	--	--	--	--	--	8.4E-02	na	--
PCB-1242	0	--	1.4E-02	na	--	--	8.4E-02	na	--	--	--	--	--	--	--	--	--	--	8.4E-02	na	--
PCB-1248	0	--	1.4E-02	na	--	--	8.4E-02	na	--	--	--	--	--	--	--	--	--	--	8.4E-02	na	--
PCB-1254	0	--	1.4E-02	na	--	--	8.4E-02	na	--	--	--	--	--	--	--	--	--	--	8.4E-02	na	--
PCB-1260	0	--	1.4E-02	na	--	--	8.4E-02	na	--	--	--	--	--	--	--	--	--	--	8.4E-02	na	--
PCB Total[C]	0	--	--	na	1.7E-03	--	--	na	2.5E-02	--	--	--	--	--	--	--	--	--	--	na	2.5E-02

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				Most Limiting Allocations			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH
Pentachlorophenol [C]	0	5.9E+00	3.9E+00	na	8.2E+01	1.5E+01	2.4E+01	na	1.2E+03	--	--	--	--	--	--	--	--	1.5E+01	2.4E+01	na	1.2E+03
Phenol	0	--	--	na	4.6E+06	--	--	na	3.1E+07	--	--	--	--	--	--	--	--	--	--	na	3.1E+07
Pyrene	0	--	--	na	1.1E+04	--	--	na	7.4E+04	--	--	--	--	--	--	--	--	--	--	na	7.4E+04
Radionuclides (pCi/l except Beta/Photon)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Gross Alpha Activity	0	--	--	na	1.5E+01	--	--	na	1.0E+02	--	--	--	--	--	--	--	--	--	--	na	1.0E+02
Beta and Photon Activity (mrem/yr)	0	--	--	na	4.0E+00	--	--	na	2.7E+01	--	--	--	--	--	--	--	--	--	--	na	2.7E+01
Strontium-90	0	--	--	na	8.0E+00	--	--	na	5.4E+01	--	--	--	--	--	--	--	--	--	--	na	5.4E+01
Tritium	0	--	--	na	2.0E+04	--	--	na	1.3E+05	--	--	--	--	--	--	--	--	--	--	na	1.3E+05
Selenium	0	2.0E+01	5.0E+00	na	1.1E+04	5.0E+01	3.0E+01	na	7.4E+04	--	--	--	--	--	--	--	--	5.0E+01	3.0E+01	na	7.4E+04
Silver	0	1.5E+01	--	na	--	3.8E+01	--	na	--	--	--	--	--	--	--	--	--	3.8E+01	--	na	--
Sulfate	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
1,1,2,2-Tetrachloroethane [C]	0	--	--	na	1.1E+02	--	--	na	1.6E+03	--	--	--	--	--	--	--	--	--	--	na	1.6E+03
Tetrachloroethylene [C]	0	--	--	na	8.9E+01	--	--	na	1.3E+03	--	--	--	--	--	--	--	--	--	--	na	1.3E+03
Thallium	0	--	--	na	6.3E+00	--	--	na	4.2E+01	--	--	--	--	--	--	--	--	--	--	na	4.2E+01
Toluene	0	--	--	na	2.0E+05	--	--	na	1.3E+06	--	--	--	--	--	--	--	--	--	--	na	1.3E+06
Total dissolved solids	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Toxaphene [C]	0	7.3E-01	2.0E-04	na	7.5E-03	1.8E+00	1.2E-03	na	1.1E-01	--	--	--	--	--	--	--	--	1.8E+00	1.2E-03	na	1.1E-01
Tributyltin	0	4.6E-01	6.3E-02	na	--	1.1E+00	3.8E-01	na	--	--	--	--	--	--	--	--	--	1.1E+00	3.8E-01	na	--
1,2,4-Trichlorobenzene	0	--	--	na	9.4E+02	--	--	na	6.3E+03	--	--	--	--	--	--	--	--	--	--	na	6.3E+03
1,1,2-Trichloroethane [C]	0	--	--	na	4.2E+02	--	--	na	6.3E+03	--	--	--	--	--	--	--	--	--	--	na	6.3E+03
Trichloroethylene [C]	0	--	--	na	8.1E+02	--	--	na	1.2E+04	--	--	--	--	--	--	--	--	--	--	na	1.2E+04
2,4,6-Trichlorophenol [C]	0	--	--	na	6.5E+01	--	--	na	9.7E+02	--	--	--	--	--	--	--	--	--	--	na	9.7E+02
2-(2,4,5-Trichlorophenoxy) propionic acid (Silvex)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Vinyl Chloride [C]	0	--	--	na	6.1E+01	--	--	na	9.1E+02	--	--	--	--	--	--	--	--	--	--	na	9.1E+02
Zinc	0	2.4E+02	1.3E+02	na	6.9E+04	6.1E+02	7.7E+02	na	4.6E+05	--	--	--	--	--	--	--	--	6.1E+02	7.7E+02	na	4.6E+05

Notes:

1. All concentrations expressed as micrograms/liter (ug/l), unless noted otherwise
2. Discharge flow is highest monthly average or Form 2C maximum for Industries and design flow for Municipals
3. Metals measured as Dissolved, unless specified otherwise
4. "C" indicates a carcinogenic parameter
5. Regular WLAs are mass balances (minus background concentration) using the % of stream flow entered above under Mixing Information.
   Antidegradation WLAs are based upon a complete mix.
6. Antideg. Baseline = (0.25(WQC - background conc.) + background conc.) for acute and chronic
   = (0.1(WQC - background conc.) + background conc.) for human health
7. WLAs established at the following stream flows: 1Q10 for Acute, 30Q10 for Chronic Ammonia, 7Q10 for Other Chronic, 30Q5 for Non-carcinogens,
   Harmonic Mean for Carcinogens, and Annual Average for Dioxin. Mixing ratios may be substituted for stream flows where appropriate.

Metal	Target Value (SSTV)
Antimony	2.9E+04
Arsenic	3.4E+02
Barium	na
Cadmium	4.4E+00
Chromium III	2.9E+02
Chromium VI	1.6E+01
Copper	3.0E+01
Iron	na
Lead	5.5E+01
Manganese	na
Mercury	3.4E-01
Nickel	7.9E+01
Selenium	1.8E+01
Silver	1.5E+01
Zinc	2.4E+02

Note: do not use QL's lower than the minimum QL's provided in agency guidance

Facility = Doswell WWTP existing
Chemical = Ammonia
Chronic averaging period = 30
WLAa = 46
WLAc = 13
Q.L. = .2
# samples/mo. = 12
# samples/wk. = 3

Summary of Statistics:

observations = 1
Expected Value = 7.8
Variance = 21.9024
C.V. = 0.6
97th percentile daily values = 18.9806
97th percentile 4 day average = 12.9775
97th percentile 30 day average = 9.40721
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:

7.8

Guidance Memorandum No. 00-2011 directs that an ammonia effluent concentration of 9 mg/L be used to evaluate the need for an ammonia limitation for a municipal discharge. Although this discharge consists predominantly of industrial wastewater, it is reasonable to check to see if the cited guidance would result in a limitation. In this case, the permit already limits TKN to 13 mg/L. Ammonia typically makes up 40% to 60% of the TKN in a municipal effluent. Ammonia makes up 46% of the TKN in the Bear Island wastewater (see "Outfall 001 – Supplement to Table I"). Using 60% as a worse case scenario, the ammonia concentration could be as high 7.8 mg/L, which is the concentration used in the above analysis (13 x 0.6 = 7.8). The above result that "no limit is required" establishes that the TKN limitation is also protective of the ammonia water quality standard. (See Attachment 6B for ammonia data on Outfall 001.)

Facility = Doswell WWTP existing
Chemical = Chloride
Chronic averaging period = 4
WLAa = 2100000
WLAc = 1400000
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 1
Expected Value = 29000
Variance = 3027600
C.V. = 0.6
97th percentile daily values = 70569.1
97th percentile 4 day average = 48249.9
97th percentile 30 day average = 34975.5
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:

29000

Facility = Doswell WWTP existing
Chemical = Total Residual Chlorine
Chronic averaging period = 4
WLAa = 47
WLAc = 66
Q.L. = 0.1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 3
Expected Value = 360
Variance = 46656
C.V. = 0.6
97th percentile daily values = 876.030
97th percentile 4 day average = 598.964
97th percentile 30 day average = 434.179
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

A limit is needed based on Acute Toxicity

Maximum Daily Limit = 47
Average Weekly Limit = 47
Average Monthly Limit = 47

The data are:

190
410
480

Chlorine is not used for disinfection at the Doswell treatment plant and chlorine is not used in the Bear Island process. The above concentrations were determined in conjunction with the failed *Ceriodaphnia dubia* chronic bioassay test in March 2007 (see Attachment 8). These TRC concentrations are believed to be false positives due to possible interference by manganese or alkalinity. Because chlorine is not used at either site, limitations are not included in the draft permit. (It is not appropriate to "force" chlorine limitations with an input of value of 20,000 µg/L per Guidance Memorandum No. 00-2011 because chlorine is not added to the system at any point.)

Facility = Doswell WWTP existing
Chemical = Dissolved Copper
Chronic averaging period = 4
WLAa = 75
WLAc = 58
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 1
Expected Value = 6
Variance = 12.96
C.V. = 0.6
97th percentile daily values = 14.6005
97th percentile 4 day average = 9.98274
97th percentile 30 day average = 7.23631
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:

6

The dissolved copper data reported with the permit renewal application were 6 µg/L, <5 µg/L, and <5 µg/L (see Attachment 6A). In accordance with a memorandum dated January 29, 2003 from Allan Brockenbrough regarding mixed data sets that include censored data (values reported as less than a quantification limit (QL)) and uncensored data (>QL; i.e., a real number), the reasonable potential analysis is initially done using only the uncensored data. If limitations are not indicated, then the analysis is complete. That is the case with the copper data.

Facility = Doswell WWTP
Chemical = Cyanide
Chronic averaging period = 4
WLAa = 54
WLAc = 31
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 2
Expected Value = 10.5
Variance = 39.69
C.V. = 0.6
97th percentile daily values = 25.5508
97th percentile 4 day average = 17.4697
97th percentile 30 day average = 12.6635
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:

11
10

The cyanide data reported with the permit renewal application were 11 µg/L, 10 µg/L, and <10 µg/L (see Attachment 6A). In accordance with a memorandum dated January 29, 2003 from Allan Brockenbrough regarding mixed data sets that include censored data (values reported as less than a quantification limit (QL)) and uncensored data (>QL; i.e., a real number), the reasonable potential analysis is initially done using only the uncensored data. If limitations are not indicated, then the analysis is complete. That is the case with the cyanide data. Note in Attachment 6A that a cyanide study was conducted starting in March 2004 and ending in October 2005. The above data are consistent with the data collected during that study period. Although the data from the cyanide study are more than three years old, they are still representative and could have been included in the above analysis. The above analysis using only two data points is a more extreme analysis however, which indicates that limitations are not needed.

Facility = Doswell WWTP existing
Chemical = Dissolved Lead
Chronic averaging period = 4
WLAa = 890
WLAc = 91
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 1
Expected Value = 30
Variance = 324
C.V. = 0.6
97th percentile daily values = 73.0025
97th percentile 4 day average = 49.9137
97th percentile 30 day average = 36.1815
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:

30

The dissolved lead data reported with the permit renewal application were (all in µg/L): <20, <20, 30, <20, <20, <20, <20, <20, <20, and <20 (see Attachment 6A). In accordance with a memorandum dated January 29, 2003 from Allan Brockenbrough regarding mixed data sets that include censored data (values reported as less than a quantification limit (QL)) and uncensored data (>QL; i.e., a real number), the reasonable potential analysis is initially done using only the uncensored data. If limitations are not indicated, then the analysis is complete. That is the case with the lead data.

Facility = Doswell WWTP existing
Chemical = Dissolved Zinc
Chronic averaging period = 4
WLAa = 610
WLAc = 770
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 11
Expected Value = 133.937
Variance = 1605.77
C.V. = 0.299185
97th percentile daily values = 222.573
97th percentile 4 day average = 175.236
97th percentile 30 day average = 147.698
< Q.L. = 0
Model used = lognormal

No Limit is required for this material

The data are:

108
101
134
218
173
98
113
110
104
109
204

Attachment 8

WET Evaluation

Attachment 8

VPDES Permit VA00029521 – Doswell Wastewater Treatment Plant

Results of acute toxicity tests during term of current permit:

Permit endpoints: $LC_{50} \geq 100\%$
NOEC $\geq$ 21% at 5.8 MGD

TEST DATE	*Ceriodaphnia dubia*		*Pimephales promelas*		Laboratory
	LC_{50}	PERCENT SURVIVAL IN 100% EFFLUENT	LC_{50}	PERCENT SURVIVAL IN 100% EFFLUENT	
February 2004	>100	100	>100	95	Coastal Bioanalysts
April 2005	>100	100	>100	100	J. R. Reed
April 2006	>100	100	>100	100	J. R. Reed
March 2007	>100	100	>100	100	J. R. Reed
February 2008	>100	100	>100	100	J. R. Reed

Results of chronic toxicity tests during term of current permit:

TEST DATE**	*Ceriodaphnia dubia*		*Pimephales promelas*		Laboratory
	Survival	Reproduction	Survival	Reproduction	
February 2004	100	61	100	100	Coastal Bioanalysts
April 2005	100	50	100	100	J. R. Reed
April 2006	invalid		100	100	J. R. Reed
May 2006 (1)	100	50			J. R. Reed
March 2007	100	<6.25 (2)	100	100	J. R. Reed
April 2007 (1)	100	100			J. R. Reed
April 2007 (1)	100	100			Coastal Bioanalysts
February 2008	100	<4 (3)	100	100	J. R. Reed
April 2008 (1)	100	100 (4)			J. R. Reed
April 2008 (1)	100	100			Coastal Bioanalysts

(1) Retest
(2) Total residual chlorine concentrations were detected in the samples received at the laboratory. Those concentrations were determined to be false positives; chlorine is not used for disinfection of final effluent. Also, subsequent screening tests at Bear Island did not indicate toxicity.
(3) Laboratory noted presence of large brown cotton shaped solids that surrounded the *C. dubia* during the test period.
(4) Laboratory noted presence of brown cotton shaped solids in one of the three samples collected for the test. Also, total residual chlorine concentrations were detected in the samples received at the laboratory. Those concentrations are considered to be false positives.

Discussion

Acute toxicity is not indicated.

Chronic toxicity (reproduction effect) may be indicated. The retests however, did not confirm the toxic effects.

The proposed permit requires the continuation of annual acute and chronic WET testing with *Ceriodaphnia dubia* and *Pimephales promelas.* The results of those tests will be evaluated for reasonable potential at the conclusion of the permit term, or sooner if toxicity is noted, and appropriate effluent limitations established.

Spreadsheet for determination of WET test endpoints or WET limits

	Excel 97			Acute Endpoint/Permit Limit			Use as LC_{50} in Special Condition, as TUa on DMR					
	Revision Date: 01/10/05											
	File: WETLIM10.xls			ACUTE	100% =	NOAEC	LC_{50} =	NA	% Use as	NA	TUa	
	(MIX.EXE required also)											
				ACUTE WLAa		0.74312586	Note: Inform the permittee that if the mean of the data exceeds					
							this TUa:	1.0	a limit may result using WLA.EXE			
				Chronic Endpoint/Permit Limit			Use as NOEC in Special Condition, as TUc on DMR					
				CHRONIC	7.431258803	TU_c	NOEC =	14	% Use as	7.14	TU_c	
				BOTH*	7.431258803	TU_c	NOEC =	14	% Use as	7.14	TU_c	
Enter data in the cells with blue type:				AML	7.431258803	TU_c	NOEC =	14	% Use as	7.14	TU_c	
Entry Date:		08/13/08		ACUTE WLAa,c		7.43125862		Note: Inform the permittee that if the mean				
Facility Name:		Doswell WWTP		CHRONIC WLAc		6		of the data exceeds this TUc:			3.0538362	
VPDES Number:		VA0029521		* Both means acute expressed as chronic				a limit may result using WLA.EXE				
Outfall Number:		1										
				% Flow to be used from MIX.EXE				**Difuser /modeling study?**				
Plant Flow:		5.8	MGD					Enter Y/N	n			
Acute 1Q10:		27	MGD	31.73	%			Acute	1	:1		
Chronic 7Q10:		29	MGD	100	%			Chronic	1	:1		
Are data available to calculate CV? (Y/N)				N	(Minimum of 10 data points, same species, needed)					Go to Page 2		
Are data available to calculate ACR? (Y/N)				N	(NOEC<LC50, do not use greater/less than data)					Go to Page 3		
IWC_a		40.37001204	%	Plant flow/plant flow + 1Q10		NOTE: If the IWCa is >33%, specify the						
IWC_c		16.66666667	%	Plant flow/plant flow + 7Q10		NOAEC = 100% test/endpoint for use						
Dilution, acute		2.477086207	100/IWCa									
Dilution, chronic		6	100/IWCc									
WLA_a		0.743125862	Instream criterion (0.3 TUa) X's Dilution, acute									
WLA_c		6	Instream criterion (1.0 TUc) X's Dilution, chronic									
$WLA_{a,c}$		7.431258621	ACR X's WLA_a - converts acute WLA to chronic units									
ACR -acute/chronic ratio		10	LC50/NOEC (Default is 10 - if data are available, use tables Page 3)									
CV-Coefficient of variation		0.6	Default of 0.6 - if data are available, use tables Page 2)									
Constants	eA	0.4109447	Default = 0.41									
	eB	0.6010373	Default = 0.60									
	eC	2.4334175	Default = 2.43									
	eD	2.4334175	Default = 2.43 (1 samp)		No. of sample	1	**The Maximum Daily Limit is calculated from the lowest LTA, X's eC. The LTAa,c and MDL using it are driven by the ACR.					
$LTA_{a,c}$		3.053836345	WLAa,c X's eA									
LTA_c		3.6062238	WLAc X's eB							Rounded NOEC's		%
MDL** with $LTA_{a,c}$		7.431258803	TU_c	NOEC =	13.456670	(Protects from acute/chronic toxicity)				NOEC =	14	%
MDL** with LTA_c		8.775448104	TU_c	NOEC =	11.395429	(Protects from chronic toxicity)				NOEC =	12	%
AML with lowest LTA		7.431258803	TU_c	NOEC =	13.456670	Lowest LTA X's eD				NOEC =	14	
IF ONLY ACUTE ENDPOINT/LIMIT IS NEEDED, CONVERT MDL FROM TU_c to TU_a												
										Rounded LC50's		%
MDL with $LTA_{a,c}$		0.74312586	TU_a	LC50 =	134.566704	%	Use NOAEC=100%			LC50 =	NA	%
MDL with LTA_c		0.87754481	TU_a	LC50 =	113.954295	%	Use NOAEC=100%			LC50 =	NA	

Page 2 - Follow the directions to develop a site specific CV (coefficient of variation)

IF YOU HAVE AT LEAST 10 DATA POINTS THAT				Vertebrate			Invertebrate	
ARE QUANTIFIABLE (NOT "<" OR ">")				IC_{25} Data			IC_{25} Data	
FOR A SPECIES, ENTER THE DATA IN EITHER				or			or	
COLUMN "G" (VERTEBRATE) OR COLUMN				LC_{50} Data	LN of data		LC_{50} Data	LN of data
"J" (INVERTEBRATE). THE 'CV' WILL BE				***********			************	
PICKED UP FOR THE CALCULATIONS			1	0		1	0	
BELOW. THE DEFAULT VALUES FOR eA,			2			2		
eB, AND eC WILL CHANGE IF THE 'CV' IS			3			3		
ANYTHING OTHER THAN 0.6.			4			4		
			5			5		
			6			6		
			7			7		
Coefficient of Variation for effluent tests			8			8		
			9			9		
CV =	0.6	(Default 0.6)	10			10		
			11			11		
δ^2 =	0.3074847		12			12		
δ =	0.554513029		13			13		
			14			14		
Using the log variance to develop eA			15			15		
	(P. 100, step 2a of TSD)		16			16		
Z = 1.881 (97% probability stat from table			17			17		
A =	-0.88929666		18			18		
eA =	0.410944686		19			19		
			20			20		
Using the log variance to develop eB								
	(P. 100, step 2b of TSD)		St Dev	NEED DATA	NEED DATA	St Dev	NEED DAT/	NEED DATA
δ_4^2 =	0.086177696		Mean	0	0	Mean	0	0
δ_4 =	0.293560379		Variance	0	0.000000	Variance	0	0.000000
B =	-0.50909823		CV	0		CV	0	
eB =	0.601037335							
Using the log variance to develop eC								
	(P. 100, step 4a of TSD)							
δ^2 =	0.3074847							
δ =	0.554513029							
C =	0.889296658							
eC =	2.433417525							
Using the log variance to develop eD								
	(P. 100, step 4b of TSD)							
n =	1	This number will most likely stay as "1", for 1 sample/month.						
δ_n^2 =	0.3074847							
δ_n =	0.554513029							
D =	0.889296658							
eD =	2.433417525							

Page 3 - Follow directions to develop a site specific ACR (Acute to Chronic Ratio)

To determine Acute/Chronic Ratio (ACR), insert usable data below. Usable data is defined as valid paired test results, acute and chronic, tested at the same temperature, same species. The chronic NOEC must be less than the acute LC_{50}, since the ACR divides the LC_{50} by the NOEC. LC_{50}'s >100% should not be used.

Table 1. ACR using Vertebrate data

Set #	LC_{50}	NOEC	Test ACR	Logarithm	Geomean	Antilog	ACR to Use
1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
				ACR for vertebrate data:			0

Table 1. Result:	Vertebrate ACR	0
Table 2. Result:	Invertebrate ACR	0
	Lowest ACR	Default to 10

Table 2. ACR using Invertebrate data

Set #	LC_{50}	NOEC	Test ACR	Logarithm	Geomean	Antilog	ACR to Use
1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
				ACR for vertebrate data:			0

Convert LC_{50}'s and NOEC's to Chronic TU's for use in WLA.EXE

Table 3. ACR used: 10

	Enter LC_{50}	TUc	Enter NOEC	TUc
1		NO DATA		NO DATA
2		NO DATA		NO DATA
3		NO DATA		NO DATA
4		NO DATA		NO DATA
5		NO DATA		NO DATA
6		NO DATA		NO DATA
7		NO DATA		NO DATA
8		NO DATA		NO DATA
9		NO DATA		NO DATA
10		NO DATA		NO DATA
11		NO DATA		NO DATA
12		NO DATA		NO DATA
13		NO DATA		NO DATA
14		NO DATA		NO DATA
15		NO DATA		NO DATA
16		NO DATA		NO DATA
17		NO DATA		NO DATA
18		NO DATA		NO DATA
19		NO DATA		NO DATA
20		NO DATA		NO DATA

If WLA.EXE determines that an acute limit is needed, you need to convert the TUc answer you get to TUa and then an LC50, enter it here:

enter it here:	NO DATA	%LC_{50}
	NO DATA	TUa

DILUTION SERIES TO RECOMMEND

Table 4.

	Monitoring % Effluent	Monitoring TUc	Limit % Effluent	Limit TUc
Dilution series based on data mean	32.7	3.0538362		
Dilution series to use for limit			14	7.1428571
Dilution factor to recommend:	0.5722386		0.3741657	
Dilution series to recommend:	100.0	1.00	100.0	1.00
	57.2	1.75	37.4	2.67
	32.7	3.05	14.0	7.14
	18.7	5.34	5.2	19.09
	10.72	9.33	2.0	51.02
Extra dilutions if needed	6.14	16.30	0.7	136.36
	3.51	28.48	0.3	364.43

Cell: I9
Comment:
This is assuming that the data are Type 2 data (none of the data in the data set are censored - "<" or ">").

Cell: K18
Comment: This is assuming that the data are Type 2 data (none of the data in the data set are censored - "<" or ">").

Cell: J22
Comment: Remember to change the "N" to "Y" if you have ratios entered. otherwise, they won't be used in the calculations.

Cell: C40
Comment:
If you have entered data to calculate an ACR on page 3, and this is still defaulted to "10", make sure you have selected "Y" in cell E21

Cell: C41
Comment: If you have entered data to calculate an effluent specific CV on page 2, and this is still defaulted to "0.6", make sure you have selected "Y" in cell E20

Cell: L48
Comment:
See Row 151 for the appropriate dilution series to use for these NOEC's

Cell: G62
Comment:
Vertebrates are:
Pimephales promelas
Oncorhynchus mykiss
Cyprinodon variegatus

Cell: J62
Comment:
Invertebrates are:
Ceriodaphnia dubia
Mysidopsis bahia

Cell: C117
Comment: Vertebrates are:

Pimephales promelas
Cyprinodon variegatus

Cell: M119
Comment: The ACR has been picked up from cell C34 on Page 1. If you have paired data to calculate an ACR, enter it in the tables to the left, and make sure you have a "Y" in cell E21 on Page 1. Otherwise, the default of 10 will be used to convert your acute data.

Cell: M121
Comment: If you are only concerned with acute data, you can enter it in the NOEC column for conversion and the number calculated will be equivalent to the TUa. The calculation is the same: 100/NOEC = TUc or 100/LC50 = TUa.

Cell: C138
Comment: Invertebrates are:

Ceriodaphnia dubia
Mysidopsis bahia

Spreadsheet for determination of WET test endpoints or WET limits

Excel 97
Revision Date: 01/10/05
File: WETLIM10.xls
(MIX.EXE required also)

Acute Endpoint/Permit Limit — Use as LC_{50} in Special Condition, as TUa on DMR

ACUTE	100% =	NOAEC	LC_{50} =	NA	% Use as	NA	TUa
ACUTE WLAa		0.71151577	Note: Inform the permittee that if the mean of the data exceeds				
			this TUa:	1.0	a limit may result using WLA.EXE		

Chronic Endpoint/Permit Limit — Use as NOEC in Special Condition, as TUc on DMR

CHRONIC	7.115157903	TU_c	NOEC =	15	% Use as	6.66	TU_c
BOTH*	7.115157903	TU_c	NOEC =	15	% Use as	6.66	TU_c
AML	7.115157903	TU_c	NOEC =	15	% Use as	6.66	TU_c
ACUTE WLAa,c		7.11515773		Note: Inform the permittee that if the mean			
CHRONIC WLAc		5.57413249		of the data exceeds this TUc:			2.92393622
* Both means acute expressed as chronic				a limit may result using WLA.EXE			

Enter data in the cells with blue type:

Entry Date:	08/13/08	
Facility Name:	Doswell WWTP	
VPDES Number:	VA0029521	
Outfall Number:	1	
Plant Flow:	6.34	MGD
Acute 1Q10:	27	MGD
Chronic 7Q10:	29	MGD

% Flow to be used from MIX.EXE

32.21	%
100	%

Difuser /modeling study?

Enter Y/N	n	
Acute	1	:1
Chronic	1	:1

Are data available to calculate CV? (Y/N)	N	(Minimum of 10 data points, same species, needed)	Go to Page 2
Are data available to calculate ACR? (Y/N)	N	(NOEC<LC50, do not use greater/less than data)	Go to Page 3

IWC_a	42.16350662	%	Plant flow/plant flow + 1Q10
IWC_c	17.94001132	%	Plant flow/plant flow + 7Q10

NOTE: If the IWCa is >33%, specify the NOAEC = 100% test/endpoint for use

Dilution, acute	2.371719243	100/IWCa
Dilution, chronic	5.574132492	100/IWCc
WLA_a	0.711515773	Instream criterion (0.3 TUa) X's Dilution, acute
WLA_c	5.574132492	Instream criterion (1.0 TUc) X's Dilution, chronic
$WLA_{a,c}$	7.115157729	ACR X's WLA_a - converts acute WLA to chronic units
ACR -acute/chronic ratio	10	LC50/NOEC (Default is 10 - if data are available, use tables Page 3)
CV-Coefficient of variation	0.6	Default of 0.6 - if data are available, use tables Page 2)
Constants eA	0.4109447	Default = 0.41
eB	0.6010373	Default = 0.60
eC	2.4334175	Default = 2.43
eD	2.4334175	Default = 2.43 (1 samp) No. of sample 1

**The Maximum Daily Limit is calculated from the lowest LTA, X's eC. The LTAa,c and MDL using it are driven by the ACR.

$LTA_{a,c}$	2.923936358	WLAa,c X's eA			
LTA_c	3.350261543	WLAc X's eB			
MDL** with $LTA_{a,c}$	7.115157903	TU_c	NOEC =	14.054502	(Protects from acute/chronic toxicity)
MDL** with LTA_c	8.152585068	TU_c	NOEC =	12.266048	(Protects from chronic toxicity)
AML with lowest LTA	7.115157903	TU_c	NOEC =	14.054502	Lowest LTA X's eD

Rounded NOEC's		%
NOEC =	15	%
NOEC =	13	%
NOEC =	15	

IF ONLY ACUTE ENDPOINT/LIMIT IS NEEDED, CONVERT MDL FROM TU_c to TU_a

MDL with $LTA_{a,c}$	0.71151579	TU_a	LC50 =	140.545019	%	Use NOAEC=100%
MDL with LTA_c	0.815258507	TU_a	LC50 =	122.660480	%	Use NOAEC=100%

Rounded LC50's		%
LC50 =	NA	%
LC50 =	NA	

Page 2 - Follow the directions to develop a site specific CV (coefficient of variation)

IF YOU HAVE AT LEAST 10 DATA POINTS THAT				Vertebrate			Invertebrate	
ARE QUANTIFIABLE (NOT "<" OR ">")				IC_{25} Data			IC_{25} Data	
FOR A SPECIES, ENTER THE DATA IN EITHER				or			or	
COLUMN "G" (VERTEBRATE) OR COLUMN				LC_{50} Data	LN of data		LC_{50} Data	LN of data
"J" (INVERTEBRATE). THE 'CV' WILL BE				***********			***********	
PICKED UP FOR THE CALCULATIONS			1	0		1	0	
BELOW. THE DEFAULT VALUES FOR eA,			2			2		
eB, AND eC WILL CHANGE IF THE 'CV' IS			3			3		
ANYTHING OTHER THAN 0.6.			4			4		
			5			5		
			6			6		
			7			7		
Coefficient of Variation for effluent tests			8			8		
			9			9		
CV =	0.6	(Default 0.6)	10			10		
			11			11		
δ^2 =	0.3074847		12			12		
δ =	0.554513029		13			13		
			14			14		
Using the log variance to develop eA			15			15		
	(P. 100, step 2a of TSD)		16			16		
Z = 1.881 (97% probability stat from table			17			17		
A =	-0.88929666		18			18		
eA =	0.410944686		19			19		
			20			20		
Using the log variance to develop eB								
	(P. 100, step 2b of TSD)		St Dev	NEED DATA	NEED DATA	St Dev	NEED DATA	NEED DATA
δ_4^2 =	0.086177696		Mean	0	0	Mean	0	0
δ_4 =	0.293560379		Variance	0	0.000000	Variance	0	0.000000
B =	-0.50909823		CV	0		CV	0	
eB =	0.601037335							
Using the log variance to develop eC								
	(P. 100, step 4a of TSD)							
δ^2 =	0.3074847							
δ =	0.554513029							
C =	0.889296658							
eC =	2.433417525							
Using the log variance to develop eD								
	(P. 100, step 4b of TSD)							
n =	1	This number will most likely stay as "1", for 1 sample/month.						
δ_n^2 =	0.3074847							
δ_n =	0.554513029							
D =	0.889296658							
eD =	2.433417525							

Page 3 - Follow directions to develop a site specific ACR (Acute to Chronic Ratio)

To determine Acute/Chronic Ratio (ACR), insert usable data below. Usable data is defined as valid paired test results, acute and chronic, tested at the same temperature, same species. The chronic NOEC must be less than the acute LC_{50}, since the ACR divides the LC_{50} by the NOEC. LC_{50}'s >100% should not be used.

Table 1. ACR using Vertebrate data

Set #	LC_{50}	NOEC	Test ACR	Logarithm	Geomean	Antilog	ACR to Use
1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA

ACR for vertebrate data: 0

Table 1. Result:	Vertebrate ACR	0
Table 2. Result:	Invertebrate ACR	0
	Lowest ACR	Default to 10

Table 2. ACR using Invertebrate data

Set #	LC_{50}	NOEC	Test ACR	Logarithm	Geomean	Antilog	ACR to Use
1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA

ACR for vertebrate data: 0

DILUTION SERIES TO RECOMMEND

Table 4.

	Monitoring % Effluent	Monitoring TUc	Limit % Effluent	Limit TUc
Dilution series based on data mean	34.2	2.9239362		
Dilution series to use for limit			15	6.6666667
Dilution factor to recommend:	0.5848117		0.3872983	
Dilution series to recommend:	100.0	1.00	100.0	1.00
	58.5	1.71	38.7	2.58
	34.2	2.92	15.0	6.67
	20.0	5.00	5.8	17.21
	11.70	8.55	2.3	44.44
Extra dilutions if needed	6.84	14.62	0.9	114.76
	4.00	25.00	0.3	296.30

Convert LC_{50}'s and NOEC's to Chronic TU's for use in WLA.EXE

Table 3. ACR used: 10

	Enter LC_{50}	TUc	Enter NOEC	TUc
1		NO DATA		NO DATA
2		NO DATA		NO DATA
3		NO DATA		NO DATA
4		NO DATA		NO DATA
5		NO DATA		NO DATA
6		NO DATA		NO DATA
7		NO DATA		NO DATA
8		NO DATA		NO DATA
9		NO DATA		NO DATA
10		NO DATA		NO DATA
11		NO DATA		NO DATA
12		NO DATA		NO DATA
13		NO DATA		NO DATA
14		NO DATA		NO DATA
15		NO DATA		NO DATA
16		NO DATA		NO DATA
17		NO DATA		NO DATA
18		NO DATA		NO DATA
19		NO DATA		NO DATA
20		NO DATA		NO DATA

If WLA.EXE determines that an acute limit is needed, you need to convert the TUc answer you get to TUa and then an LC50, enter it here:

enter it here:	NO DATA	$\%LC_{50}$
	NO DATA	TUa

Cell: I9
Comment:
This is assuming that the data are Type 2 data (none of the data in the data set are censored - "<" or ">").

Cell: K18
Comment: This is assuming that the data are Type 2 data (none of the data in the data set are censored - "<" or ">").

Cell: J22
Comment: Remember to change the "N" to "Y" if you have ratios entered, otherwise, they won't be used in the calculations.

Cell: C40
Comment:
If you have entered data to calculate an ACR on page 3, and this is still defaulted to "10", make sure you have selected "Y" in cell E21

Cell: C41
Comment: If you have entered data to calculate an effluent specific CV on page 2, and this is still defaulted to "0.6", make sure you have selected "Y" in cell E20

Cell: L48
Comment:
See Row 151 for the appropriate dilution series to use for these NOEC's

Cell: G62
Comment:
Vertebrates are:
Pimephales promelas
Oncorhynchus mykiss
Cyprinodon variegatus

Cell: J62
Comment:
Invertebrates are:
Ceriodaphnia dubia
Mysidopsis bahia

Cell: C117
Comment: Vertebrates are:

Pimephales promelas
Cyprinodon variegatus

Cell: M119
Comment: The ACR has been picked up from cell C34 on Page 1. If you have paired data to calculate an ACR, enter it in the tables to the left, and make sure you have a "Y" in cell E21 on Page 1. Otherwise, the default of 10 will be used to convert your acute data.

Cell: M121
Comment: If you are only concerned with acute data, you can enter it in the NOEC column for conversion and the number calculated will be equivalent to the TUa. The calculation is the same: 100/NOEC = TUc or 100/LC50 = TUa.

Cell: C138
Comment: Invertebrates are:

Ceriodaphnia dubia
Mysidopsis bahia

Attachment 9

Revision of Control Equation

- Refer to page 2, item #3 of July 12, 1978 (copy attached).

    NOD concentration for 6.0 mg/l TKN equals $6 \times 4.5 \times 0.25 = 6.75$ (instead of 15.75).

    Therefore, $LW_u = 1.5625\ LW_5 + 6.75$ (ref. eqn(1), p2)

    substituting and solving as before,

    $$LW_5 = 3.4 \frac{Q_s}{Q_w} + 0.3 \quad \text{(ref. eqn (3), p 3)}$$

    For simplicity, omit 0.3 which makes insignificant contribution.

    Therefore, new control equation is

    $$LW_5 = 3.4 \frac{Q_s}{Q_w}$$

- The control equation must now be adjusted to reflect the Doswell water treatment plant and BIPCo raw water intakes on the North Anna above the discharge point. The intake capacities are 3.0 MGD for Doswell and 4.0 MGD for BIPCo. (See attached letter dated May 6, 1985 from Mr. John Jackson, County administrator.)

    $7\ MGD \times 1.55 = 10.85$ cfs

Therefore, control equation becomes

$$LW_5 = 3.4 \frac{Q_s - 10.85}{Q_w}$$

- using new control equation, the 7 day/10 year allocation is:

Q_W = 5.0 MGD : 1 MGD Doswell ; 4 MGD BIPCO. BIPCO is in the early stages of planning for a mill expansion to double production. Wastewater flow projected at 4 MGD.

$$LW_5 = 3.4 \frac{(43.68 - 10.85)}{5 MGD (1.55)}$$

$$= 14.4 \text{ mg/l}$$

14.4 mg/l × 5 MGD × 8.34 = 600 lbs/day

- The current permit establishes a maximum discharge of 1500 #/d BOD_5 and TSS. This value is based on 1 MGD from Doswell at 30 mg/l and 3 MGD from BIPCO at 50 mg/l. (The 3 MGD represented a doubling of the facility based on the initial design flow of 1.5 MGD.) The attached graph titled "BIPCO Effluent Storage Analysis" was prepared by BIPCO's consultant Mr. John Combs for a meeting on May 2, 1985. At a BIPCO effluent flow of 4 MGD, this graph indicates that the current maximum of 1500 #/d (which corresponds to approx. 100 cfs stream flow) does not allow emptying of the storage basin in a reasonable period of time. The Company has therefore, requested that a new maximum be established based on a stream flow of 300 cfs. As the control equation establishes an allowable discharge given any stream flow, an increase in the maximum limitation is acceptable. Using the control equation, the maximum limitation based on 300 cfs is:

$$LW_5 = 3.4\,\frac{(300 - 10.85)}{5(1.55)}$$

$$= 127 \text{ mg/l}$$

$$127 \text{ mg/l} \times 5 \text{ MGD} \times 8.34 = 5296 \text{ \#/d}$$

say <u>5300 #/d</u>

RRJ
5-21-85

MEMORANDUM

State Water Control Board

2111 North Hamilton Street P. O. Box 11143 Richmond, VA. 23230

SUBJECT: Amendment of Doswell NPDES Permit, VA0029521. Supplement to Memorandum dated June 19, 1978

TO: File (42-0525)

FROM: Ray R. Jenkins, Jr. Ray Jenkins

DATE: July 12, 1978

COPIES: L. G. Lawson, J. J. Cibulka, W. D. Jones, Dale F. Jones

On June 28, 1978, Wes Jones, John Combs, and the writer traveled to Philadelphia, Pennsylvania to discuss the proposed Doswell tiered permit with personnel of the EPA's Region III Office. The attached list of people were in attendance.

All aspects of the proposed permit and some of the reasons for proposing a tiered permit were discussed. One of the most significant results of the meeting was the realization that the modeling recalculations detailed in the June 19, 1978, memorandum were not entirely appropriate. Charlie App pointed out that not only did the York River Basin 303(e) plan allocate wasteloads, but it also established a stream modeling methodology that took into accounty NOD(nitrogeneous oxygen demand) and a 20% reserve assimilative capacity (p.53, 67-69 and Appendix F from the plan are attached). In our original work, it had been decided that we would strickly follow the methodology (no NOD or reserve) used in the 1973 Doswell modeling. (It should be noted that the 303(e) Plan indicates that NOD and a 20 % reserve were taken into account in establishing the 200 #d/ $CBOD_5$ allocation. These values however, were derived (back-calculated) from the 200 #/d $CBOD_5$ allocation as this allocation was already in the Doswell NPDES permit when the Plan was prepared.) Charlie App advised that if changes in the allocation and therefore, the 303(e) Plan were to be proposed, the changes should incorporate the modeling methodology outlined in the Plan. These changes essentially involved reassigning rate coefficients to be consistent with other modeling in the Basin Plan, and encorporating the methodology of Appendix F.

The attached memorandum titled "Proposed Discharge to North Anna River, Hanover County" dated June 30, 1978 details the inputs to the modeling as described above. The UCBOD to $CBOD_5$ ratio was 1.25 (ref. Appendix F). The particular modeling effort detailed in the June 30 memorandum was intended to define the 7 day/10 year low flow allocation. It also served as a check on the accuracy of the $CBOD_5$ control equation which was generated by letting L_o (now UOD of the discharge-river mix) be the input variable to the modeling equation (refer to June 19 memorandum for methodology).

Following the procedure detailed in the June 19, 1978, memorandum, the allowable L_o using the revised rate coefficients was determined to be 7.2 mg/l. The critical dissolved oxygen deficit of 0.96 mg/l occurred just prior to the confluence of the North and South Anna Rivers. The river was observed to recover with the entry of the South Anna River.

The revised control equation was generated through the following approach, which is in accordance with the Plan methodology. The NOD was subtracted from the discharge concentration in ultimate demand terms. The resultant was converted to 5-day demand and the 20% reserve was subtracted. The resulting expression was rewritten in order that the UOD of the wastewater could be substituted into the mass balance equation of the wastewater-river mix, which was set equal to 7.2 mg/l. The wastewater TKN concentration was calculated to be 14 mg/l using 1.0 MGD of Doswell wastewater at 20 mg/l TKN and 1.5 MGD of BATO wastewater at 10 mg/l TKN. This wastewater mix can be considered to be a worst case condition in that any increase in BATO flow above 1.5 MGD would lower the TKN concentration of the combined discharge. Assuming such a "worst case" TKN concentration was considered preferable to adding another variable (TKN) to the control equation.

The following computations delineate the derivation of the revised control equation:

1. Ultimate oxygen demand (UOD) = ultimate CBOD + nitrogenous oxygen demand (NOD).

2. UOD #/d = $LW_u \times Q_w \times 8.34$, where LW_u = ultimate oxygen demand of waste; and Q_w = wastewater flow rate (MGD)

3. NOD = $15.75 \times Q_w \times 8.34$

$$15.75 = 0.25^* \times 4.5 \times \frac{20\,(1) + 10\,(1.5)}{1 + 1.5}$$

* see p. 53 from York 303 (e), attached

4. UCBOD x 0.8 = $CBOD_5$ ($UCBOD/CBOD_5$ = 1.25)

5. 20% reserve = $CBOD_5 \times 0.8$

Therefore BOD_5 discharge in #/d =

$$0.8 \times 0.8 \times \left[(LW_u \times Q_w \times 8.34) - (15.75 \times Q_w \times 8.34)\right]$$

BOD_5 (#/d) ÷ $(8.34 \times Q_w)$ = discharge $CBOD_5$ concentration = LW_5

Therefore,

$$LW_5 = \frac{0.8 \times 0.8 \times \left[(LW_u \times Q_w \times 8.34) - (15.75 \times Q_w \times 8.34)\right]}{8.34 \times Q_w}$$

solving for LW_u:

$$LW_u = 1.5625\ LW_5 + 15.75 \qquad \text{Equation (1)}$$

Remembering now that L_0 must equal 7.2 mg/l, the following mass balance equation can be written:

$$\frac{(LW_u \times Q_w) + (1.875^{**} \times Q_s)}{Q_w + Q_s} = 7.2 \qquad \text{Equation (2)}$$

** stream background UCBOD

Substituting equation (1) into (2) yields,

$$\frac{\left[(1.5625\ LW_5 + 15.75) \times Q_w\right] + (1.875 \times Q_s)}{Q_w + Q_s} = 7.2$$

Solving for LW_5 and simplifying,

$$LW_5 = 3.4\ \frac{Q_s}{Q_w} - 5.5. \qquad \text{Equation (3)}$$

This expression will be the permit controlling equation for allowable $CBOD_5$ discharge based upon the water quality standards. (This expression replaces equation (1) in the June 19 memorandum.)

At a 7 day/10 year low flow of 43.68 cfs (North Anna and Little Rivers) and a wastewater flow of 2.5 MGD, the allowable $CBOD_5$ discharge from equation (3) is 684 #/d. This compares well with the value computed from the 7 day/10 year modeling detailed in the June 30, 1978, memorandum, which is as follows:

1407	#/d	UOD
- 330	#/d	NOD ***
1077	#/d	UCBOD
÷1.25		ratio of UCBOD to $CBOD_5$
861.6		
-20%		reserve
690	#/d	allowable $CBOD_5$ discharge

*** Doswell: 20 mg/l TKN x .25 x 4.5 x 1.0 x 8.34 = 188 #/d
BATO : 10 mg/l TKN x .25 x 4.5 x 1.5 x 8.34 = 140 #/d
328 #/d

The 6 #/d difference is the result of not including Q_w in the wastewater-river mass balance when establishing the 7.2 mg/l mix concentration.

Another item discussed with the EPA personnel was the location of stream flow measurement. The State Water Control Board (previously the USGS) maintains a gaging station on the North Anna River at the Route 1 bridge (approximately 8 miles above the discharge point.) At the suggestion of EPA, it was agreed that this gage would provide the most reliable stream measurement. It should be noted that by measuring stream flow at this point, some additional conservatism is added to the control equation (i.e.; use of this measurement excludes a segment flow of 0.45 cfs between the gage and the discharge point, and the Little River at 1.77 cfs, both flows being 7 day/10 year low flows; the conservatism is a result of the fact that these flows were included in the derivation of Equation (3)).

One final item discussed with the EPA was statement number 4 on page 5 of the June 19, 1978, memorandum. There is some difference of opinion concerning the direction of change of K_2 once the model enters the Pamunkey River. In any event, the present modeling used a K_2 computed in accordance with Appendix F.

In accordance with the revised low flow allocation generated in accordance with the 303(e Plan methodology as described above, it is proposed to modify the York River Basin 303(e) Plan to show a 7 day/10 year low flow allocation of 690 #/d BOD_5. This figure accounts for a 20% reserve assimilative capacity and an NOD of 330 #/d. The ultimate oxygen demand would be 1407 #/d.

ntp

Attendees - 6/28/78 Meeting on Hanover Co.

Bill Sergdoria	EPA III - Enf	597-8211
Charles App	EPA III - Water Planning	597-8323
Tiny Hodgkiss	EPA III - Enforcement	597-2945
Stuart Kerzner	EPA III - Water Planning	597-3847
Michael Zickler	" Enforcement	597-2726
Paul E Ambrose	EPA III Enforcement	597-2459
Wesley D. Jone	VSWCB	804-897-0056
Ray R. Jenkins, Jr.	Va. SWCB - PRO	804 257-12..
James ... Combs	Roy F. Weston	804-2..-405

#

Stan Laskowski

Recent evidence reported in the literature indicates that nitrogenous BOD demand occurs in all parts of a river system.[1] The ultimate nitrogenous BOD was calculated stoichiometrically, and each segment of the basin was assigned a percentage of ultimate nitrogenous BOD as follows, to reflect the detention time available for the BOD to take effect:

- Headwaters - 25%
- Tidal/Non-Tidal Interface 50%
- Tidal - 100%

Maximum daily loads for any stream segment depend on its flow and on the location and magnitude of point discharges. Lake Anna will change the low-flow conditions in the downstream portion of the North Anna River and in the Pamunkey River. Then the assimilative capacity of the rivers will be much greater because supplemental water discharged from the lake can maintain a higher level of stream flow, and, therefore, the rivers can accommodate higher maximum daily loads. The maximum daily loads for all segments are presented in Table IV-2.

C. Identification and Location of Water Quality Violations

1. Dissolved Oxygen (DO) Problems

Water quality violations were identified by applying BPCTCA (1977) levels of treatment (obtained from EPA effluent guidelines) and the Virginia water quality standards (Appendix D) to point source discharges. The Virginia standard for DO is a minimum of 5.0 mg/L, and State policy on non-degradation limits the DO decrease to 0.2 mg/L. Water quality conditions were modeled to determine assimilative capacities of major streams in the York System. A summary of assumptions made for this modeling effort is presented in Appendix F. The results of the selected alternatives are depicted in Figures IV-3 through IV-7.

a. South Anna River

Figure IV-3 presents the dissolved oxygen profile for the South Anna River under 1977 loading conditions. The treatment plants in the headwaters (Gordonsville and Louisa-Mineral) are required to provide 92 and 93 percent carbonaceous BOD removal. The high degree of removal is necessitated by the relatively low stream flow and the correspondingly low assimilative capacity of the headwaters.

---

[1] "Zones of Nitrification", T. J. Tuffely, J. V. Hunter and V. A. Matulewic, AWRA, Volume 10, No. 3, June 1974

All fecal coliform contamination in the lower York River Basin cannot be attributed to traditional sources. Chesapeake Corporation may be discharging organisms that have been identified as fecal coliform. It is possible that this may be due to organism misidentification, and Chesapeake Corporation has contracted with VIMS to determine this possibility. The results of this study could have significant impact on condemned shellfish areas.

Although no loading reduction has been established for Contrary Creek, an abatement program is being implemented to reduce the Creek's acid mine drainage. This program includes the following:

- Restore and regrade surrounding areas to minimize erosion and remove tailing piles.
- Mix soil with limestone, appropriate fertilizer, and digested sludge.
- Seed the entire area to establish a vegetative cover.
- Dredge Contrary Creek.
- Develop a monitoring program, involving:
    - Continuous flow at selected locations.
    - Grab samples at selected locations (including Lake Anna) for analysis of heavy metals.

The influence of salt marsh discharges is clearly illustrated in the DO profile for the Pamunkey River (Figure IV-6). This water quality segment was modeled under 1977 loading conditions with zero discharge from all point sources. The conclusions were that this segment is water quality limited by natural causes and that the discharges of Chesapeake Corporation and of the proposed Hanover County regional treatment plant will have little effect on water quality in this segment.

G. Allocation of Reduction Responsibilities

No specific loading reductions are required for any segment in the York River Basin.

H. Assignment of Effluent Limitations

During the course of this study, the rivers, streams, and creeks were analyzed to determine waste load assimilative capacities. Recommendations for 1977 waste loads are based on the magnitude of waste load at each significant point source required to maintain high quality water. Twenty percent of that load has been set aside as a reserve wherever possible.

Table IV-5 shows the recommended effluent limitations in terms of BOD_5 and Ultimate BOD. The first column is the waste load allocation for 1977; these waste discharges were used to establish the existing water quality, which was defined as that resulting after the 1977 effluent limitations were applied.

The maximum daily load allocations were determined by calculating the magnitude of the daily load beyond the 1977 baseline load that could be added without decreasing the DO at the sag point more than 0.2 mg/L (the state policy on non-degradation). The recommended allocation is 80% of the maximum (wherever possible), which reserves 20% as a safety factor. Required removal efficiency to meet the maximum daily load by 1995 is also provided.

TABLE IV-5

WASTE LOAD ALLOCATIONS (IN LBS PER DAY)

POINT SOURCE	1977 WASTE LOAD[2]		MAXIMUM DAILY LOAD		RECOMMENDED ALLOCATION			RAW WASTE LOAD AT 1995		REQUIRED % REMOVAL EFFICIENCY 1995	
	$CBOD_5$	UBOD[1]	$CBOD_5$	UBOD	$CBOD_5$	UBOD	PERCENT RESERVE	$CBOD_5$	UBOD	$CBOD_5$	UBOD
Gordonsville	145	398	150	412	150	412	0	1950	2730	92	85
Louisa-Mineral	50	108	55	118	55	118	0	850	1150	93	90
Doswell	52	110	250	417	200	334	20	1080	1444	85(4)	71
Thornburg	63	150	68	162	68	162	0	1240	1690	94	90
Bowling Green	27	64	29	68	29	68	0	680	926	96	93
Ashland	160	303	235	559	188	447	20	2250	3825	92	88
Hanover (Regional STP)	170	437	280	820	280	820	0	5730	7930	96	90
Chesapeake Corp.	6400	8000	6170[5]	7710[5]	6170[5]	7710[5]	N/A	51700	64630	90	90
West Point	105	380	281[3]	1020	225	814	20	1000	1600	85[4]	66
York & James City SD #1	213	641	2630[3]	7843	2100	6270	20	4480	6780	85[4]	72
American Oil	406	1360	73[5]	245	73	245	N/A	4620	6630	96	98
York Regional STP	2280	9230	10000[3]	40900	8010	32700	20	26900	44900	85[4]	67

[1]UBOD is Ultimate Biochemical Oxygen Demand. Its concentration is derived by the following: $BOD_5/0.80 + 4.5\ (TKN) = (UBOD)$
NOTE: The amount of TKN utilized depends on the location in the basin.

[2]Projected for 1977 based on population projections.
[3]Recommended allocation based on BPCTCA effluent guidelines applied to raw waste loads at 2020.
[4]Minimum removal efficiency.
[5]Allocation based on BATEA Guidelines at 2020.
[6]Based on assumed influent characteristics.

APPENDIX F: CALCULATION OF ASSIMILATIVE CAPACITY AND WASTELOAD ALLOCATIONS FOR OXYGEN-DEMANDING MATERIALS IN NON-TIDAL AND TIDAL STREAMS

I. Non-Tidal

In the modeling of all non-tidal streams, a modified Streeter-Phelps oxygen-sag model was used for both carbonaceous and nitrogenous oxygen-demanding materials. The basic equation utilized in the simulation may be written as:

$$D = \frac{E_1 La}{K_2 - K_1} \left(e^{-K_1 t} - e^{-K_2 t}\right) + D_a e^{-K_2 t}$$

where D = oxygen deficit at time t (mg/l)

D_a = oxygen deficit at origin, where t = o (mg/l)

L_a = ultimate oxygen demand in stream at origin (mg/L)

K_1 = log base e deoxygenation coefficient

K_2 = log base e reaeration coefficient

t = time of travel from origin

K_2 values for all streams were calculated using critical low-flow stream depths and velocities, and K_1 was chosen to conform to a typical sanitary waste and to provide the most reasonable fit to existing stream dissolved oxygen data. It must be emphasized that, in all cases, existing stream data were minimal with respect to water quality, and the modeling parameters used must be regarded as best available estimates which may be considered adequate only for purposes of interim planning. Further explanation of the model components is presented in the following paragraphs.

a. Ultimate Biochemical (Carbonaceous) Oxygen Demand (UBCOD)

The amount of ultimate CBOD discharge is calculated by multiplying reported BOD_5 loadings by 1.25 or by the following equation:

$$\text{UCBOD (lbs/day)} = \frac{\text{Effluent } BOD_5 \text{ concentrations (mg/l)} \times \text{flow(mgd)} \times 8.34}{0.8}$$

b. Ultimate Nitrogenous Oxygen Demand

Ultimate nitrogenous oxygen demands (UNOD) are calculated stoichiometrically as follows:

UNOD (lbs/day) = effluent TKN concentration (mg/l)
x flow (mgd x 4.5 x 8.34)

Wherever the effluent concentration of TKN is not available, 20 mg/L is used as the effluent concentration unless otherwise indicated.

c. Ultimate Oxygen Demand

The ultimate oxygen demand at the point of discharge is equal to the sum of ultimate carbonaceous biochemical oxygen demand and nitrogenous oxygen demand.

d. Non-Point Source Contribution

In general, non-point sources of oxygen demanding material are not adequately defined and must at present be considered as a background dissolved oxygen deficit. In the absence of actual stream water quality data, values between 1.0 and 2.0 mg/L were used.

e. Waste Load Distribution

In the process of evaluating stream assimilative capacity, it is necessary to determine the decay of waste loads from all points of discharge as materials flow downstream. For any given segment this may be expressed as follows:

$$L = L_o \exp(-K_1 t)$$

where L_o = ultimate oxygen demand at the upstream end of the segment

K_1 = coefficient of deoxygenation at the ambient stream temperature

t = average time of travel to the point of application in the segment at the 7-day, 10-year average low-flow conditions

f. Critical Low Flow

The 7-day average low flow with a 10-year return period was used for analysis. Annual low-flow series for Virginia were obtained form USGS gaging station records. For segments lacking a gaging station, the critical flow was obtained based on known drainage basin areas and geologic considerations.

g. Velocity and Depth

Stream hydraulic characteristics were estimated from maps and field data, since stream sampling and geometry data were not available.

h. Temperature

In this study, the temperature used in modeling the non-tidal stream segments is 25°C. Statistical analysis showed 25° to be the critical temperature.

i. DO Saturation

Dissolved oxygen concentrations at saturation used in these computations are taken from the table of saturation values found in "Standard Methods for the Examination of Water and Wastewater", 13th edition.

j. Deoxygenation and Reaeration Rate

The deoxygenation rate, K_1 is estimated by the discharged waste characteristics. Further refinement in K_1 is not justified on the basis of existing data. The above rate is considered to be an appropriate average for both carbonaceous and nitrogenous materials within the context of this study.

The reaeration rate K_2 is estimated from the O'Connor-Dobbins formula. It is based on estimated hydraulic depths and velocities. Generally, K_2 values have a higher level of confidence than K_1 values in this study.

Both K_1 and K_2 are corrected for ambient stream temperatures according to the relationships:

$$K_1 = K_{1_{20^\circ}} (1.047)^{T-20}$$

and $$K_2 = K_{2_{20^\circ}} (1.024)^{T-20}$$

where K_1, K_2 = corrected rate constants (day $^{-1}$)

$K_{1_{20^\circ}}$, $K_{2_{20^\circ}}$ = estimated rate constants at $T = 20^\circ C$ (day $^{-1}$)

T = Ambient Stream Temperature ($^\circ C$)

k. Stream Assimilative Capacity

A discussion of stream assimilative capacity is given in Chapter IV. Calculation of the assimilative capacity of each reach is based on the definition of the maximum upstream loading required to allow the stream to meet the specified dissolved oxygen criteria at each critical point (minimum points on the dissolved oxygen versus river mile curve). Since downstream conditions depend on the distribution and magnitude of all upstream discharge points, the calculated assimilative capacity (CAC) was first calculated for the upstream reaches and proceeded downstream. The magnitude and location of all point sources were accounted for in these calculations.

l. Waste Load Allocations

Using the calculated assimilative capacity (CAC), the recommended waste load allocation was calculated according to the expression:

$$\text{Waste load allocation (BOD)} = 0.8\ (\text{CAC})$$

If the projected 1977 BOD_5 load to the segment is less than the target load, allocation is required. Allocations are normally made in terms of BOD_5. However, an option for negotiation between the discharger and regulatory agencies for increasing BOD_5 discharge allocation in return for reducing ultimate biochemical oxygen demand may be considered.

2. Tidal Model

The dissolved oxygen in the tidal estuaries of the York River Basin was simulated with the use of a one-dimensional, non-steady state model developed by VIMS. This model is based on the finite element method of volume integration. It has been developed for the Virginia State Water Control Board for the specific purpose of serving as a planning and management tool in the analysis of river systems.

The model covers the physical area of the tidal portions of the Pamunkey and the Mattaponi, as well as the York estuary itself. The input data necessary for the tidal model is extensive. The main program requires the total drainage area, tidal cycles, time increments, weighting factor for avection of sea salt, Manning's roughness factor for each section, etc. In addition, sub-routines require extensive data. Fortunately, through cooperation with VIMS staff, the input requirements for this study were reduced to changes in the loadings typified by various alternatives.

One limitation of the VIMS model is its average DO predictions in the area below the Yorktown Bridge. In this area, the assumption of one-dimensionality is invalid. Significant density stratification, as well as vertical and horizontal variations, mandate a three-dimensional model. Such an effort is presently underway at VIMS. However, for the present study, the resulting dissolved oxygen values obtained in this area from the VIMS model were used to determine relative impacts. The absolute levels of dissolved oxygen in this area were obtained from a model recently completed as part of a 201 Facilities Plan for the Hampton Roads Sanitation Commission. Both models predicted little impact on water quality from point source discharges in the area below the Yorktown bridge.

MEMORANDUM

State Water Control Board

2111 North Hamilton Street P. O. Box 11143 Richmond, VA. 23230

SUBJECT: Proposed Discharge to North Anna River, Hanover County

TO: W. D. Jones

FROM: K. C. Das KCDas

DATE: June 30, 1978

COPIES: D. F. Jones, J. J. Cibulka, D. B. Richwine, J. K. Bailey, R. R. Jenkins, C. T. Bathala

In accordance with your suggestion, I am summarizing here below the results of the analysis relative to the proposed discharge into North Anna River. The methodology used herein is in keeping with the procedures as outlined in the York River Basin 303(e) Plan (Appendix F).

The 7-day, 10-year low flow was computed in the manner indicated below:

> The drainage area at the dam site is 343 sq.miles. (Ref: App. C-York Plan) The drainage area between the dam site and the outfall is 127 sq.miles. This dam will release a minimum drought flow of 40 cfs. The contribution due to an additional 127 sq.miles is 1.9 cfs based on a drought flow rate of 0.015 cfs/sq.mile. The Little River contributes 1.77 cfs at the discharge point which is based on a drainage area of 118 sq. miles. (See attached letter)

The reaeration rate was computed using O'Connor-Dobbins equation (see Appendix F of the 303(e) Plan). Using an average velocity of 0.5 fps and an average depth of 3 ft., a reaeration rate of 1.76 day^{-1} (base e, 20^{o}C) was obtained. An average depth of 3 ft. was assumed to reflect summer low flow conditions in the North Anna River. We have used the deoxygenation rate of 0.23 day^{-1} (base e, 20^{o}C). The same K_1 rate was used for discharge into South Anna River by Roy Weston. A temperature of 29^{o}C was used for the analysis which reflects the highest temperature recorded at the Rt. 30 Bridge on August 17, 1977 (see attached memo). The DO of the effluent is assumed to be 6.5 mg/l which is in agreement with the present NPDES permit limits. The results are summarized in Table 1.

If you have any questions concerning this matter, please let me know.

sw

Attachments

TABLE 1

Parameters	Proposed Discharge to North Anna River	Source of Information
Stream Characteristics		
Receiving Stream	North Anna River	North Anna River
7/10 Low Flow Upstream of Outfall (cfs)*	43.68	
Stream Velocity (fps)	0.5	**
Background DO (mg/l)	6.82	
Critical Water Temperature (^{o}C)	29	PRO
Background BOD (ultimate) (mg/l)	1.88	**
Reaction Rate Constants		
K_1 Deoxygenation (Base e, $20^{o}C$)	0.23	**
K_2 Reaeration (Base e, $20^{o}C$)	1.76	**
Allowable Effluent Limits		
Effluent Discharge (mgd)	2.5	
DO_{eff} (mg/l)	6.5	
BOD (ultimate) (mg/l)	67.5	
BOD (ultimate) (lbs/day)	1407.0	

BOD (ultimate) = CBOD (ultimate) + NBOD (ultimate)

* 7-Day, 10-Year Low Flow = 41.91 (North Anna) + 1.77 (Little Creek) = 43.68 cfs

** Information gathered via telephone conversation with Kevin Phillips of Roy Weston by PRO staff. This information was used for Pamunkey and South Anna Rivers.

Robert L. Downing, C.L.S.

William F. Goodfellow, P.E., C.L.S

Associated Engineers

ENGINEERS • SURVEYORS • PLANNERS

Post Office Box 5189 • Ashland, Virginia 23005 • Phone (A/C 703) 798-5773

JAN 19 1972

January 8, 1972

State Water Control Board
P. O. Box 11143
Richmond, Va. 23230

Attn: Mr. C. L. Jones

Dear Mr. Jones;

We are preparing a preliminary proposal submittal for a waste treatment facility to serve the community of Doswell, Va. and the Kings Dominion Amusement Park which is now under construction.

In this regard we would like to request from you the degree of treatment that will be required for this installation.

We are enclosing a data sheet and location map for your use in making your determinations.

The aforementioned amusement park is scheduled to open on April 1, 1975 and will require sewerage services approximately 6 months prior to opening. We would, therefore, appreciate your requirements and recommendations as soon as scheduling will permit.

If additional information is needed or elaboration required on the attached data please contact us at any time.

We appreciate your assistance in this matter.

Sincerely,

William F. Goodfellow

William F. Goodfellow, P. E.
Associated Engineers

1/12/72
C. L.

cc: Mr. Norman Phillips, S.H.D.

WFG/mfh

#1

Associated Engineers • Box 5189 • Ashland, Virginia 23005 • Phone 798-5773

DOSWELL WASTE TREATMENT FACILITY

DATA SHEET

A. Plant Location- Lat 37° [illegible] 31", Long 77° 25' 41", on the northwest bank of the confluence of the North Anna and Little Rivers. (See Attached Sketch).

B. Owner of Facility- County of Hanover.

C. Total Design Discharge- 1. Initial Stage - 0.5 MGD
2. Ultimate Stage - 2.0 MGD

D. Receiving Stream- North Anna and Little Rivers (Tributaries to York River)

E. Stream Particulars- 1. Drainage area at discharge point is 589 square miles (118 sq. mi. from Little River and 471 sq. mi. from North Anna River.

2. Vepco's North Anna Dam, located 29.7 miles upstream, will release a minimum drought flow of 40 CFS. Drainage area between the dam and discharge point is 127 square miles.

3. Jerrell's Truck Stop, located at U. S. Route 30 and I-95, is currently operating a waste treatment facility (sewage lagoon) which will be obviated by the County plant.

F. Other Data- A water treatment facility of equal design capacities will be constructed concurrently with the waste treatment plant and will be located approximately 1200 feet upstream.

COMMONWEALTH OF VIRGINIA
WILLIAM F. GOODFELLOW
CERTIFICATE No.
5025
CERTIFIED PROFESSIONAL ENGINEER

MEMORANDUM

State Water Control Board

2111 North Hamilton Street P. O. Box 11143 Richmond, VA. 23230

SUBJECT: Choosing Flow and Temperature Values for Modeling the North Anna River for the Doswell STP Discharge

TO: File

FROM: Joyce L. Hoyle Joyce L. Hoyle

DATE: May 23, 1978

COPIES:

The seven-day, ten-year low flow recorded at the gage on the North Anna River is 6.5 cfs (0.015 cfs/sq.mile), but this is augmented by 40 cfs from the dam. This makes the total flow above the discharge 46.5 cfs.*

The closest USGS water quality gage is on the Pamunkey River near Hanover. The monthly average temperatures for the months of May through September are shown below for the period of record.

AVERAGE MONTHLY TEMPERATURE (^{o}C)

Station: Pamunkey River near Hanover (01673000)**

Year	May	June	July	August	September
1975	19.5	25.0	25.5	25.5	22.5
1974	19.5	22.5	-	25.5	21.0
1973	19.5	23.0	25.5	27.0	24.5
1972	18.0	21.5	24.0	23.5	21.0
1971	17.5	22.5	25.5	25.0	21.0
1970	21.3	23.3	26.2	26.3	23.7
1969	19.0	23.0	25.0	24.0	-
1968	16.0	22.0	-	25.0	19.0

(-) Incomplete Data.

** Source: Water Resources Data for Virginia (1968-1975).

* See Page 56 of the York River Basin Plan.

A glance at the table above will show that 27°C was the highest monthly average temperature. The highest instantaneous temperature recorded was 28°C.

There are six ambient monitoring stations on the North Anna River in Hanover County. Ambient monitoring only records instantaneous temperatures. The highest temperature recorded at any of these stations is 29°C at the Route 30 bridge on August 17, 1977. Since the temperature of 29°C was actually recorded in the North Anna River under conditions of fairly low flow, I suggest using 29°C for modeling.

sw

MEMORANDUM

State Water Control Board

2111 North Hamilton Street P. O. Box 11143 Richmond, VA. 23230

SUBJECT: Amendment of Doswell NPDES Permit VA0029521

TO: File (42-0525)

FROM: S. S. Waldo and R. R. Jenkins

DATE: June 19, 1978

COPIES: L. G. Lawson, J. J. Cibulka, W. D. Jones, Dale F. Jones, 60-0033

By letter dated April 7, 1978, John E. Longmire, Hanover County Administrator, transmitted a permit amendment request for the Doswell Wastewater Treatment Plant. The permit amendment request reflected the discharge of treated wastewater from the proposed Bato plant. The amendment request was updated by a letter dated April 28, 1978 and completed by correspondence with transmittal dates of May 8, 1978 and May 26, 1978. Mr. Longmire requested that the Board consider a tiered permit to take into account increased assimilative capacity in the stream during the periods of high flow in the North Anna River (other permits incorporating this concept have been written in the State, although this is the first permit that incorporates an "instantaneous" correlation between river flow and discharge).

The staff has investigated the feasibility of a tiered permit concept for the Doswell permit. In that an allocation for Doswell is already included in an adopted 303(e) plan (York River Basin), the original intent of the investigation was to preserve all parameters used in the adopted allocation modeling. By retaining the original inputs, the generation of tiered levels of discharge does not constitute remodeling, but only a recalculation using the existing model. Subsequently, it was discovered that an obvious error had been made in the original allocation. The original modeling in 1973 resulted in an allowable discharge of 400 lbs/day at 2 MGD wastewater flow. But when Hanover County decided to build only a 1 MGD treatment plant, this 400 lbs/day was simply halved to obtain an allocation of 200 lbs/day. In addition, it was determined that the river temperature used in the modeling and the 7-day/10-year low flow used were incorrect. It was then decided that the errors would be corrected and appropriate revisions to the 303(e) plan proposed. These revisions were to change the stream temperature (29°C instead of 32.2°C) and to revise the flow (46.5 cfs* instead of 42.4 cfs for the North Anna River at 7-day/10-year low flow). No other changes were made; i.e., rate coefficients selected at 20°C in the original modeling (K_1* = 0.13, K_2* = 0.68), UBOD*/BOD_5* ratio(1.3),

*Terms:
cfs = cubic feet per second
K_1 = deoxygenation rate
K_2 = reaeration rate
UBOD = ultimate biochemical oxygen demand
BOD_5 = 5-day biochemical oxygen demand

etc. remain the same. The resulting calculations were run precisely in accordance with the procedure previously used in the 303(e) allocation, with the exception of the temperature change and flow change mentioned above and discussed more fully below. Thus the basic modeling remains unchanged. All inputs to the modeling equation were those determined for the seven-day/ten-year low flows; the inputs were not adjusted at increased river flows. Fixing these factors keeps the calculations more conservative (i.e., increases the "safety factors").

The original modeling used a stream temperature of 32.2°C. This temperature was taken directly from the Water Quality Standard for a Class III stream(i.e., 90°F = 32.2°C). This methodology of choosing a stream temperature was used only for a short time by the Board and since then the ambient temperature, as measured instream, has been used exclusively. For the North Anna River this temperature was determined to be 29°C, which is the maximum temperature observed.

The original modeling used a critical flow in the North Anna River of 42.4 cfs. An investigation of stream flow for the North Anna River has determined that, in fact, the critical flow is 46.5 cfs. This is based on a guaranteed release from Lake Anna of 40 cfs and a "stretch" flow in the drainage area between the lake and the Doswell gaging station of 6.5 cfs. The use of the corrected values for river temperature and flow more precisely reflect actual conditions in the stream.

In making the calculations a simplification was made by letting the input variable to the modeling equation be the ultimate biochemical oxygen demand (UBOD) of the discharge-river mix (hereafter referred to as L_o). This procedure was preferred to the more typical procedure of inputting various wastewater flow and concentration values.

When the temperature was corrected to 29°C, an additional simplification was made in the modeling. The existing Doswell permit requires a minimum dissolved oxygen (DO) level of 6.5 mg/l. At 32.2°C, the background river DO is also 6.5 mg/l. Therefore, at any wastewater volume-river volume mix, the DO of the mix is 6.5 mg/l. At 29°C, however, the background stream DO is 6.84 mg/l and the effluent DO is still 6.5 mg/l. Effluent volume now influences the DO of the mix and,therefore, influences the results of the modeling calculations. The simplification in the calculations was to input an initial DO of the mix of 6.8 mg/l. This value results from the mass balance of 4.0 MGD (in accordance with Hanover's amendment application for ultimate flows) of wastewater with a DO of 6.5 mg/l and a river flow of 49 cfs with a DO of 6.84, and should represent the lowest initial DO under any conditions (Note: The flow of 49 cfs includes 46.5 cfs from the North Anna River and the 7-day/10-year low flow of 2.5 cfs from the Little River, which enters the North Anna immediately below the discharge.). Since the effluent volume is small in comparison to total flow, this simplification impacts the results only slightly.

As a result of setting all of the foregoing parameters constant at "worst case conditions", the calculations were performed with only one variable - the UBOD of the discharge-stream mix (L_o). It was then observed that by having fixed all other input values, L_o did not change with increased river flow when the same DO value at the "sag" was calculated. Using an L_o so determined, a mass balance equation is used to calculate the allowable discharge concentration for various wastewater and stream flows. The inputs to the calculations included the Little River at a 7-day/10-year low flow of 2.5 cfs and the South Anna River 3.7 miles downstream of the discharge at a 7-day/10-year low flow of 12.1 cfs. The UBOD background of the rivers was 3.0 mg/l (BOD_5 = 3.0/1.3 = 2.3) and all stream velocities were 0.5 fps The calculations indicated that the sag point occurred below the confluence with the South Anna River. The critical dissolved oxygen deficit of 0.96 mg/l (10% of D.O. saturation at 29°C, 0.76 mg/l, plus 0.2 mg/l, anti-degradation application for this case) occurred at an L_o of 5.5 mg/l.

When used as described above, the calculations indicate that the Board's anti-degradation policy will be met as long as a UBOD (L_o) of 5.5 mg/l (UBOD/BOD_5 = 1.3; therefore, BOD_5 = 4.2 mg/l) is maintained in the mix of the stream and wastewater flow. Using this knowledge, an equation was developed which can be used to determine an allowable BOD_5 discharge concentration at various stream flows. This equation was derived from the basic mass balance equation:

$$L_{mix} = \frac{Q_s L_s + Q_w L_w}{Q_s + Q_w}$$

Where:

L_{mix} = BOD_5 of the stream-wastewater mix

Q_s = stream flow

Q_w = wastewater flow

L_s = background BOD_5 in stream

L_w = BOD_5 of wastewater

Using known values and calculating for L_w:

$$4.2 = \frac{Q_s(2.3) + Q_w L_w}{Q_s + Q_w}$$

or, in another form,

$$L_w = \frac{4.2 + 1.9Q_s}{Q_w} \qquad \text{Equation (1)}$$

Use of this equation enables an operator or a regulatory agency to easily enter stream flow and wastewater flow to determine the allowable effluent BOD_5 (L_w) which will maintain the State's water quality standards. At a wastewater flow of 2.5 MGD, which is the proposed start-up flow, and critical low flow of 49 cfs, the low flow allocation was determined to be 584 lbs/day. This low flow allocation will be one of the proposed changes to the 303(e) plan.

There is a requirement which is also controlling for this discharge. 40CFR133 limits domestic waste discharges to a concentration of 30 mg/l BOD_5 and total suspended solids (TSS). However, 40CFR133.103(b)(Secondary Treatment Definition: Industrial Waste) allows for an increase in the "secondary treatment" limitation of 30 mg/l for BOD and suspended solids in proportion to the industrial contribution to the total wastewater flow at the industrial wastewater concentration which would apply for an industrial point source discharge by that industry type. Since the Bato wastewater will be treated to levels of 50 mg/l BOD_5 and total suspended solids (which will be defined by the Board as "new source" discharge limitations for this industry), this concentration is used in the following mass balance equation to define an allowable discharge concentration for BOD_5 and total suspended solids:

$$\text{TSS or } BOD_5(\text{mg/l}) = \frac{30Q_H + 50Q_B}{Q_H + Q_B} \qquad \text{Equation (2)}$$

While the BOD_5 limitation is controlled by either Equation (1) or Equation (2), whichever is more stringent, Equation (2) is the only controlling equation for the total suspended solids discharge.

A maximum limitation has also been established for BOD_5 and total suspended solids quantity. This limitation is based on 1 MGD of Doswell wastewater at 30 mg/l BOD_5 and TSS and 3.0 MGD at Bato wastewater at 50 mg/l. The flow figures are in accordance with Hanover's amendment application. The appropriate quantity calculation gives a maximum allowable quantity discharge of 1500 lbs/day. This limit cannot be exceeded regardless of the value determined by Equations (1) or (2).

Before describing the actual proposed permit amendment, it is important to summarize the conservative factors which were used in the derivations of the above equations. These are listed below:

1. Segment flow (runoff, groundwater and small streams) was not included below the discharge point.

2. Stream velocity and other inputs to the calculation were set at critical low flow and were not changed with increased river flow.

3. A minimum initial mix DO of 6.8 mg/l was used instead of recalculating the mix at higher stream flows; recalculating would have the effect of slightly increasing the mix DO.

4. The rate of coefficients were not redefined below the confluence of the North and South Anna Rivers (deoxygenation coefficient would actually drop; reaeration coefficient would actually increase).

The investigators point out that these calculations assume a complete mix at the discharge. However, the point should also be made that this assumption is used in every "free flowing" modeling effort and is completely in accordance with prior modeling practices.

Permit Conditions

The proposed permit amendments were drafted in such a way as to maximize the use of Equations (1) and (2) above. This necessitated a unique permit in that BOD_5 and suspended solids limitations are not specifically placed in the permit. Each value must be calculated using Equations (1) or (2).

Because Equation (1) is geared towards an "instantaneous" correlation between river flow and discharge concentration, it was necessary to provide a shorter limitation period than a one month average, which is normal on most other permits. It was resolved that the BOD_5 and total suspended solids limitations will be reported as a weekly average of 7 calendar day values, and also that additional monitoring would be required to have an "instantaneous" correlation between BOD_5 and some other parameter (TOC* or COD*) to enable an operator to determine at any point in time with some degree of surety whether or not he is in compliance with the permit. The limitations included on the composite waste discharge (point source 001) are as follows:

*Terms: TOC = Total organic carbon
COD = Chemical oxygen demand

The BOD_5 limitation is referenced as paragraphs 4(a) through (d) in Part I, paragraph A-1 of the attached proposed amendments. 4(a) is a modification of Equation (1) listed above, which requires a weekly average. 4(b) does the same for Equation (2) above. 4(c) states that the more stringent of (a) and (b) above shall be the effluent BOD_5 concentration, except when flows are at 7-day/10-year low flow or less, at which time the more stringent of the following shall apply:

1. The maximum quantity allowable shall be no greater than 584 lbs (this is the waste load allocation which is proposed to be included in the 303(e) plan).

2. The concentration established by 4(b) above (which is the "secondary treatment" limitation).

4(d) states that the effluent BOD_5 quantity discharge shall not exceed 1500 lbs/day at any time.

Paragraphs 5(a) and (b) are the limitations for total suspended solids and are based on Equation (2) above modified to show a weekly average. 5(b) also limits the maximum quantity discharge at 1500 lbs/day.

Paragraph 6 is included to provide "real time" control over the amount of waste discharged. Because a lag time of 5 days is inherent in the BOD_5 test, it was realized that it was necessary to have some instantaneous determination of effluent quality for the operator to use in determining his allowable discharge. It was determined that this could be done best by a plot of TOC vs. BOD_5, which would be updated using corresponding 24-hour composite samples of TOC and BOD_5 daily. This plot would be composed of data from a rolling 30 consecutive day period so that when a new data point is added, the oldest data point would be removed. Since it is possible that a plot of TOC vs. BOD_5 might not give the best correlation for these particular wastewaters, a special requirement was included in the proposed amendment which requires the permittee to also run COD tests on the same frequency as TOC to determine if COD would be a better correlation. At the end of the first six months of operation, the results will be evaluated to determine which parameter (i.e., TOC or COD) gives the closer correlation.

It is also necessary to place monitoring requirements on the separate waste streams coming into the combined outfall so that waste quality can be determined on each. These monitoring requirements are included as paragraph A-2 for Bato and paragraph A-3 for Hanover. Additionally, it was necessary to place a total chlorine residual limitation on the effluent from Hanover which is included in Paragraph A-3. The Bato waste stream does not include any sanitary waste (it is separately transported to the Doswell plant), thus, no chlorination is required. The permit requires that a plot of TOC vs. BOD_5 will be developed for each of these waste streams so that an operator can determine immediately the approximate quality of either waste stream.

Because of the special nature of the effluent limitations for this plant, it was necessary to develop a new reporting form also. This form is attached to the memorandum. The form includes spaces for entering all parameters which will be necessary to calculate the BOD_5 and total suspended solids limitations and for reporting actual final discharge values of BOD_5, total suspended solids, pH, and dissolved oxygen (and total chlorine residual for the Doswell waste stream). In addition, a report form for the TOC, COD, and BOD_5 data used to develop the correlation plot is also included as an attachment.

Because the BOD_5 and total suspended solids limitations are based on a calendar week average, it was necessary to address this fact in the development of the monitoring report form. Paragraph 7 of Part I, A-1, states that if any month ends in an incomplete calendar week, the report for that week shall be included in the following monthly reporting period. For that reason, the report form has spaces for five weeks on it realizing that during some months there will only be three calendar weeks filled out and in others there will be five. Beyond these special reporting requirements the monitoring report form contains all the information required and included in the standard DMR format currently used in other NPDES permits, including a space for bypass and overflow information and a signature block.

The remainder of the permit shall be made up of standard pages, therefore, no discussion of those conditions is included here.

Any questions concerning the development of this proposed permit should be directed to the writers or Wesley Jones.

/pc
Attachments

Attachment 10

F. LAKE LEVEL CONTINGENCY PLAN

The intent of this condition is to allow specific reductions in the lake discharge flow when the lake water level drops below designated levels due to drought conditions, taking into account and minimizing any adverse effects of any release reduction requirements on downstream users.

1. Except as provided in 2. below, the permittee shall at all times provide a minimum instantaneous release from the Lake Anna impoundment of 40 cfs.

2. When the level in Lake Anna reaches 248 feet above mean sea level (msl), the permittee will begin reducing releases below the 40 cfs minimum in accordance with the following conditions:
   a. Minimum instantaneous releases shall not drop below 20 cfs.
   b. The Water Compliance Manager of DEQ's Piedmont Regional Office and the downstream users identified below will be given at least 72 hours notice by the permittee prior to the initiation of flow reductions:
      - Hanover County Public Utilities
      - Bear Island Paper Company
      - Engel Farms, Inc
      - Pamunkey Indian Tribal Government
   c. Skimmer gate adjustments will be performed in accordance with Station Operating Procedures.
   d. Releases shall be stepped down in increments of approximately 5 cfs with at least a 72-hour period following each incremental reduction and prior to any subsequent reduction.
   e. During the period in which releases are reduced below 40 cfs, conditions in the North Anna River shall be monitored in accordance with the monitoring plan submitted by the permittee and approved by the DEQ prior to implementation of the Lake Level Contingency Plan.
   f. Releases from the dam shall return to 40 cfs upon the Lake level returning to greater than 248 ft. msl. Increases of flow will occur in 5 cfs increments with a 24 hour wait period prior to the next gate adjustment.
   g. If any downstream user identifies an adverse effect at any time during flow reductions and notifies the DEQ of the adverse effect, the Director shall make a timely investigation. If after notice to the permittee and the affected downstream users the Director finds an adverse effect from the flow reductions, the flows shall be increased in 5 cfs increments with a 24 hour wait period prior to the next gate adjustment, until the flow reaches 40 cfs or the Director finds that the adverse effect has been eliminated.
   h. Adverse effect is defined as the inability to withdraw/discharge water for proper operation of facilities, or impairment of water quality.

Attachment 11

WATER QUALITY MODELING

NORTH ANNA AND PAMUNKEY RIVERS

YORK RIVER BASIN, VIRGINIA

Prepared for:

Bear Island Paper Company

Ashland, Virginia

HDR Project Number 317-10-35

Prepared by:

HDR Infrastructure, Inc.
6400 Fairview Road
Charlotte, North Carolina

January 1988

TABLE OF CONTENTS (continued)

ANALYSIS OF BIODEGRADABLE TKN FRACTION

Prepared for

Bear Island Paper Company and Hanover County, Virginia

INTRODUCTION

The Bear Island Paper Company operates a TMP pulp and paper mill in Ashland, Virginia. Wastewater from the mill is treated on site and is discharged into a national pollutant discharge elimination system (NPDES) regulated outfall (NPDES #VA0029521) controlled by Hanover County, Virginia. The NPDES permit was renewed in October 1985, and, as part of that renewal, the effluent standard was modified.

The previous permit had not been regulated for either ammonia or total kjeldahl nitrogen (TKN). An effluent TKN limitation of 6 mg/l was implemented as part of the permit renewal. The TKN limitation was imposed to control oxygen utilization in the receiving stream. The TKN oxygen utilization was based on 4.5 mg of oxygen per mg TKN.

The use of the TKN limit in the final October 1985 NPDES permit was a last minute alteration of the draft (as a draft of the permit had previously been based on ammonia). The assumption made by Hanover County and Bear Island Paper Company (BIPCO) in accepting the TKN limit was that the only TKN in the effluent would be in the form of ammonia nitrogen. The long-term wastewater treatment plant data had indicated that a discharge of less than 6 mg/l ammonia could be achieved. Therefore, the 6 mg/l TKN limit was thought to be an acceptable limitation.

In the final NPDES permit issuance, the State had a provision for the substituton of the ammonia limit for the TKN limit. However, any such substitution would require approval from the State Water Control Board (SWCB) staff.

Subsequent to the implementation of the revised permit, it has been found that the combined effluent consistently exceeds the 6 mg/l TKN limitation. However, the discharge has been in compliance with the 6 mg/l ammonia limitation.

HDR was retained in 1986 to evaluate this situation. A preliminary analysis was conducted which indicated that a significant portion of the TKN in the Bear Island wastewater was non-biodegradable and the use of a theoretical TKN oxygen utilization would not be correct. The program to determine oxygen utilization of the waste was conducted utilizing inhibited and noninhibited BOD analyses. The results of this program are presented in Table 1. This indicated that the TKN in the Bear Island wastewater did not exert the 4.5 mg/l oxygen demand.

Based on the results of the preliminary testing program, the Bear Island Paper Company, in conjunction with Hanover County, entered into a consent agreement with the State of Virginia. A primary objective of that consent agreement was to identify the biodegradable portion of the TKN in the BIPCO effluent.

The results of the biodegradation program are presented in this report.

BIODEGRADATION PROGRAM

The methodologies for conducting the biodegradation program followed the procedures which had been previously submitted to and approved by the SWCB. A copy of the procedure is presented in Appendix A. All samples were

TABLE 1

SUMMARY OF TKN OXYGEN UTILIZATION
BEAR ISLAND EFFLUENT

Sample Date	TKN (mg/l)	NH_3-N (mg/l)	BOD_{20} Inhibited (mg/l)	BOD_{20} Uninhibited (mg/l)	TKN Oxygen Utilization $\frac{mg\ O_2}{mg\ TKN}$	Organic Nitrogen Oxygen Utilization $\frac{mg\ O_2}{mg\ O\text{-}N}$
May 9	10.92	0.17	31	40	0.82	0.75
May 14	6.97	0.21	24	29	0.72	0.58
May 19	12.35	3.30	73	73	0	0
May 22	1.29	0.07	49	51	1.55	1.30

collected by personnel from either BIPCO or Hanover County and all analyses were conducted by Environmental Laboratories, Inc. of Ashland, Virginia.

BIODEGRADATION RESULTS

In order to determine the biodegradable portion of the TKN a series of flask tests were initiated. The first tests were set up with waste samples collected on July 14, 1987, (sulfonation being utilized) and the second set with samples collected on August 26, 1987, (TMP production with purchased Kraft). Tests were performed on both TMP with purchased Kraft and sulfonation wastewaters. Phase I consisted of sulfonation wastes and Phase II was comprised of the TMP with purchased Kraft.

The samples for analysis were prepared by combining the wastewater samples with dilution water and seed in accordance with the test procedure and were maintained in test flasks under an oxygen blanket. Samples from the TKN testing flasks were collected and analyzed every 10 days. A summary of the data from the individual flasks is presented in Appendix B.

The TKN biodegrability data for the tests are presented on Table 2. The results from the tests are plotted and are presented in Figures 1 thru 6. The analysis of the data indicates that the degradable portion on BIPCO wastewater and combined Doswell/BIPCO wastewater is very similar, i.e., 34 to 46% degradable TKN. Therefore, for the purposes of performing the water quality modeling, it is recommended that the analysis be based on 46% degradable and 54% nondegradable TKN.

TABLE 2

TKN BIODEGRADABILITY

Phase	Sample	Initial TKN, mg/l	Final TKN, mg/l	% Degradable TKN	% Non-degradable TKN
I	BIPCO	4.76	3.17	33	67
	Doswell	5.82	1.15	80	20
	Combined	6.16	4.08	34	66
II	BIPCO	11.40	6.16	46	54
	Doswell	1.89	0.22	88	12
	Combined	9.25	5.76	38	62

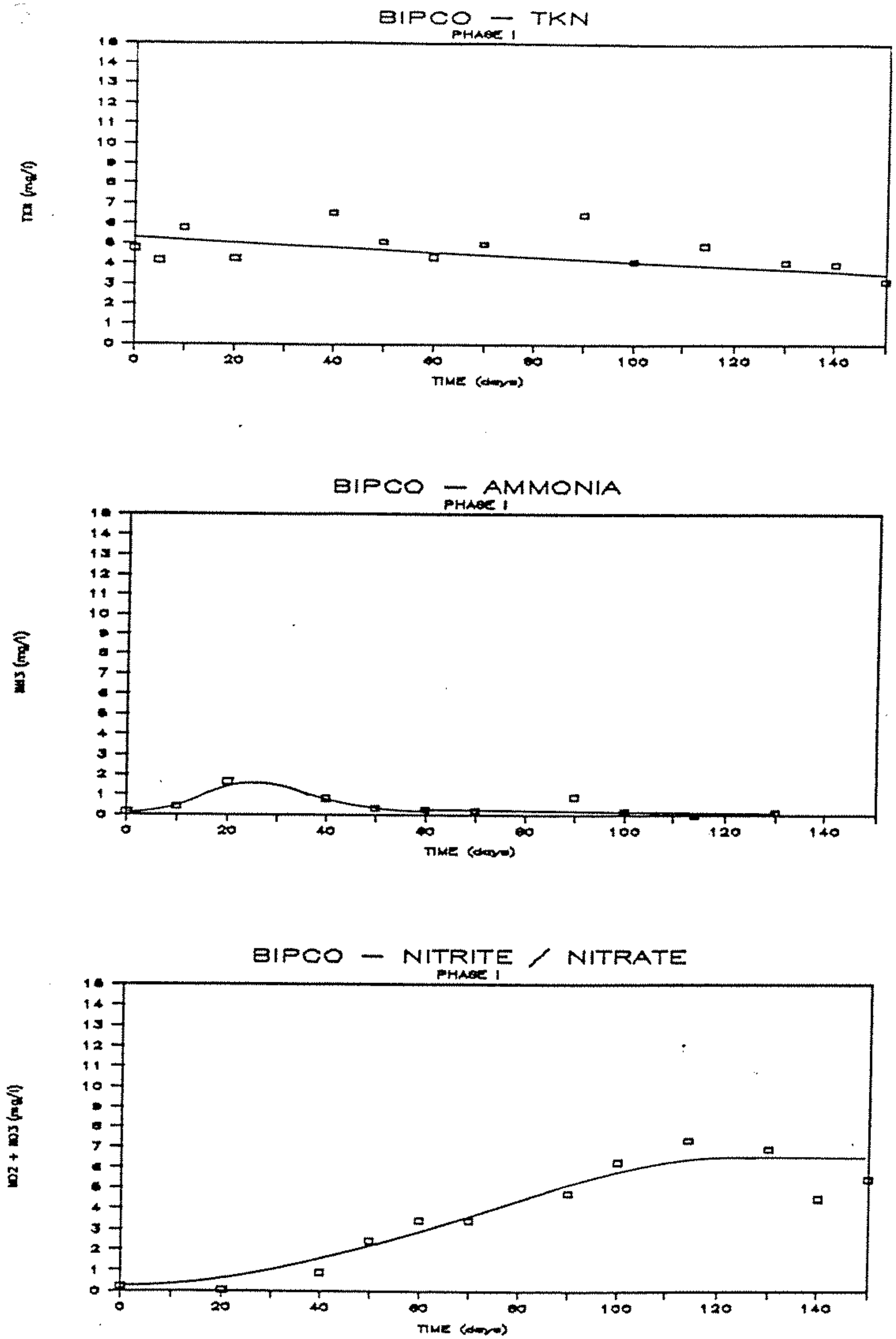


Figure 1: Chronological Variation - Phase I BIPCO

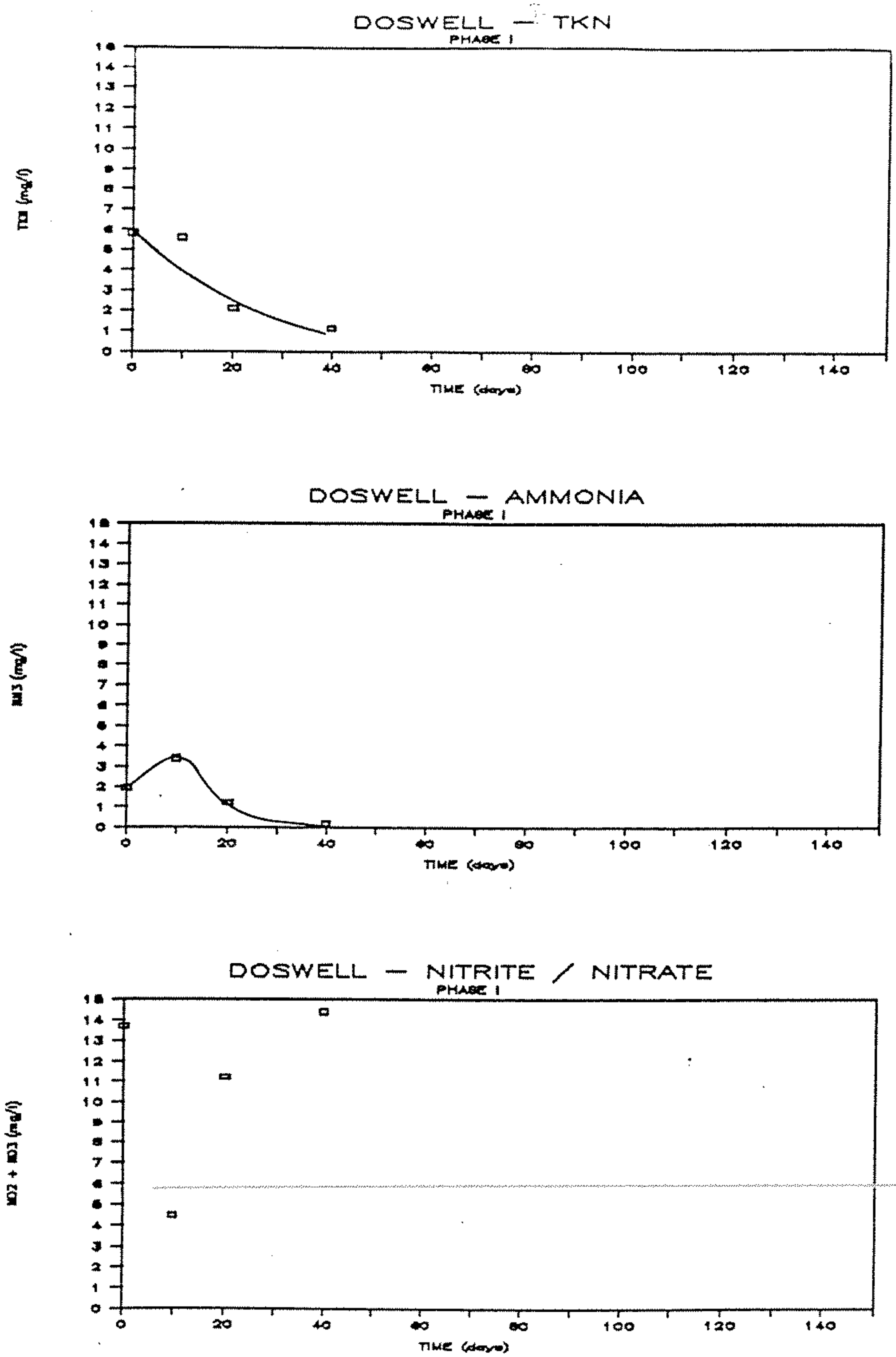


Figure 2: Chronological Variation - Phase I Doswell

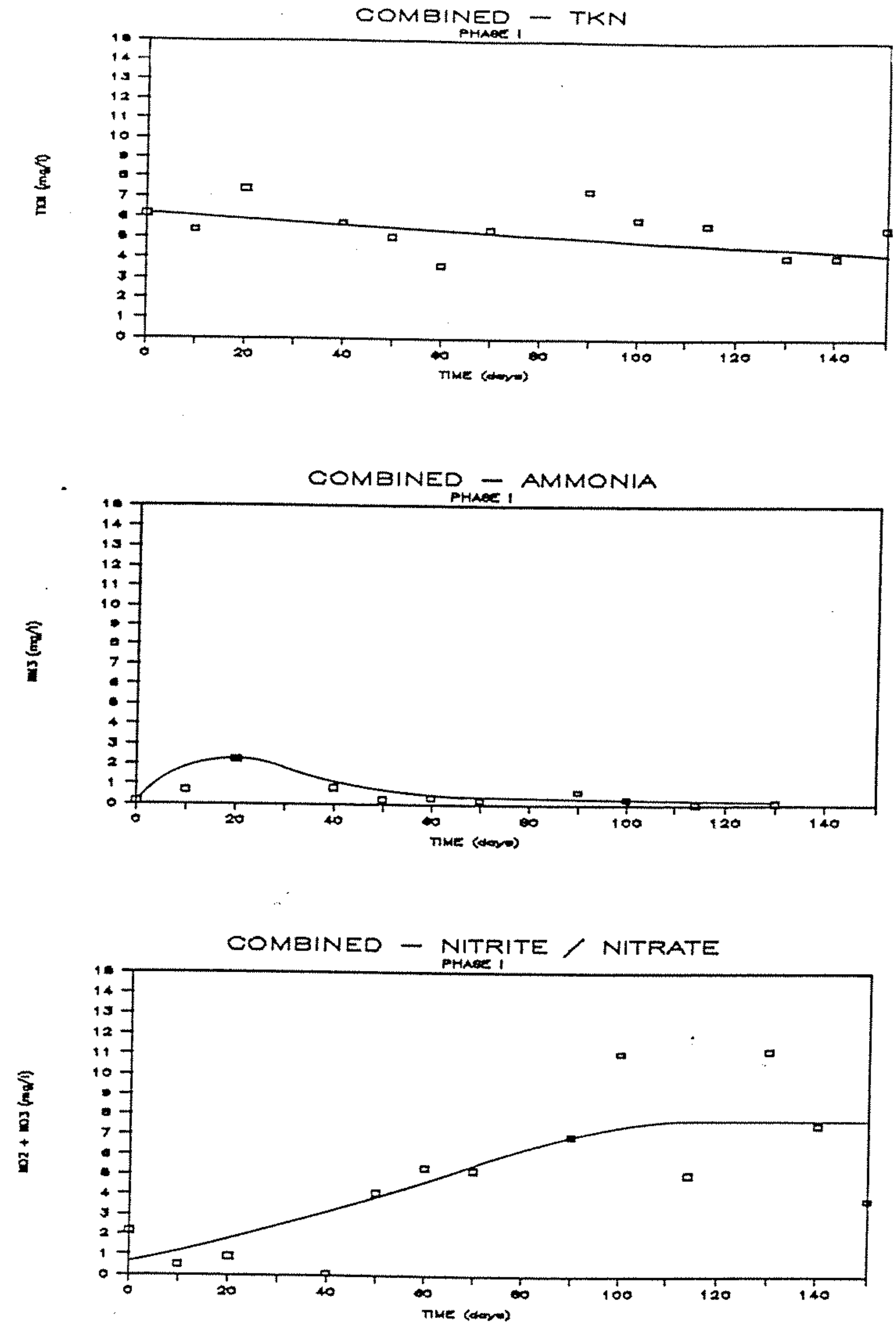


Figure 3: Chronological Variation - Phase I Combined

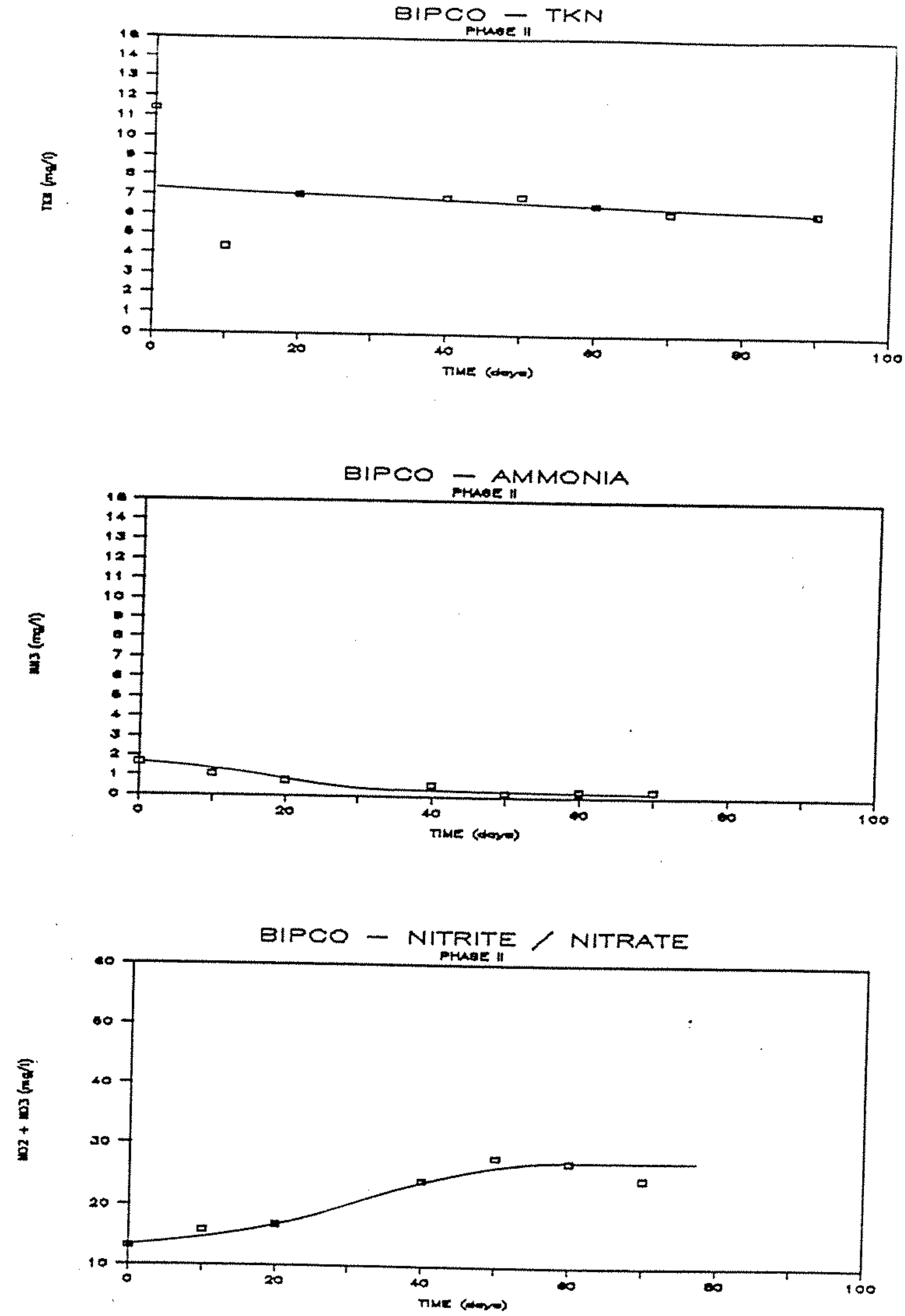


Figure 4: Chronological Variation - Phase II BIPCO

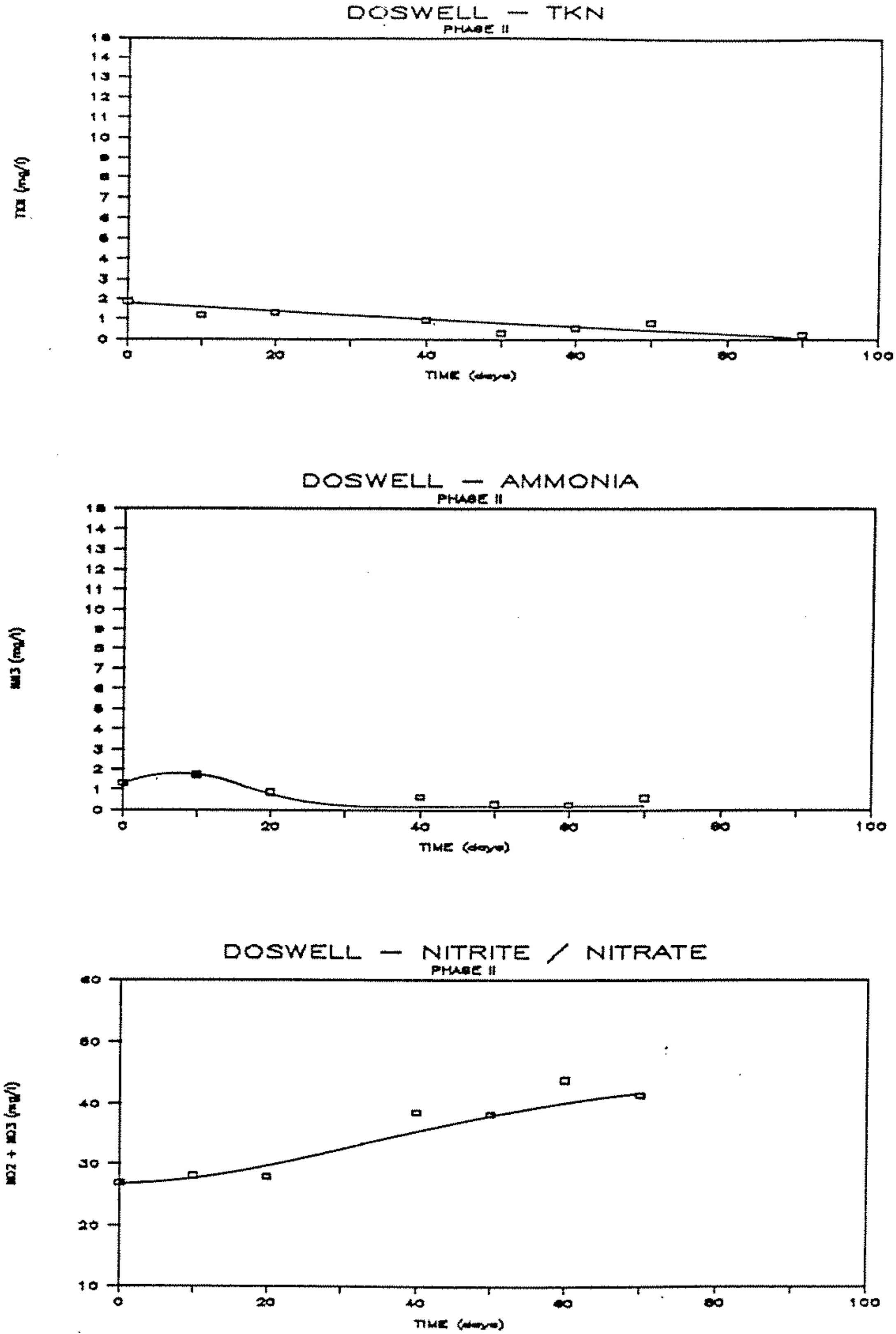


Figure 5: Chronological Variation - Phase II Doswell

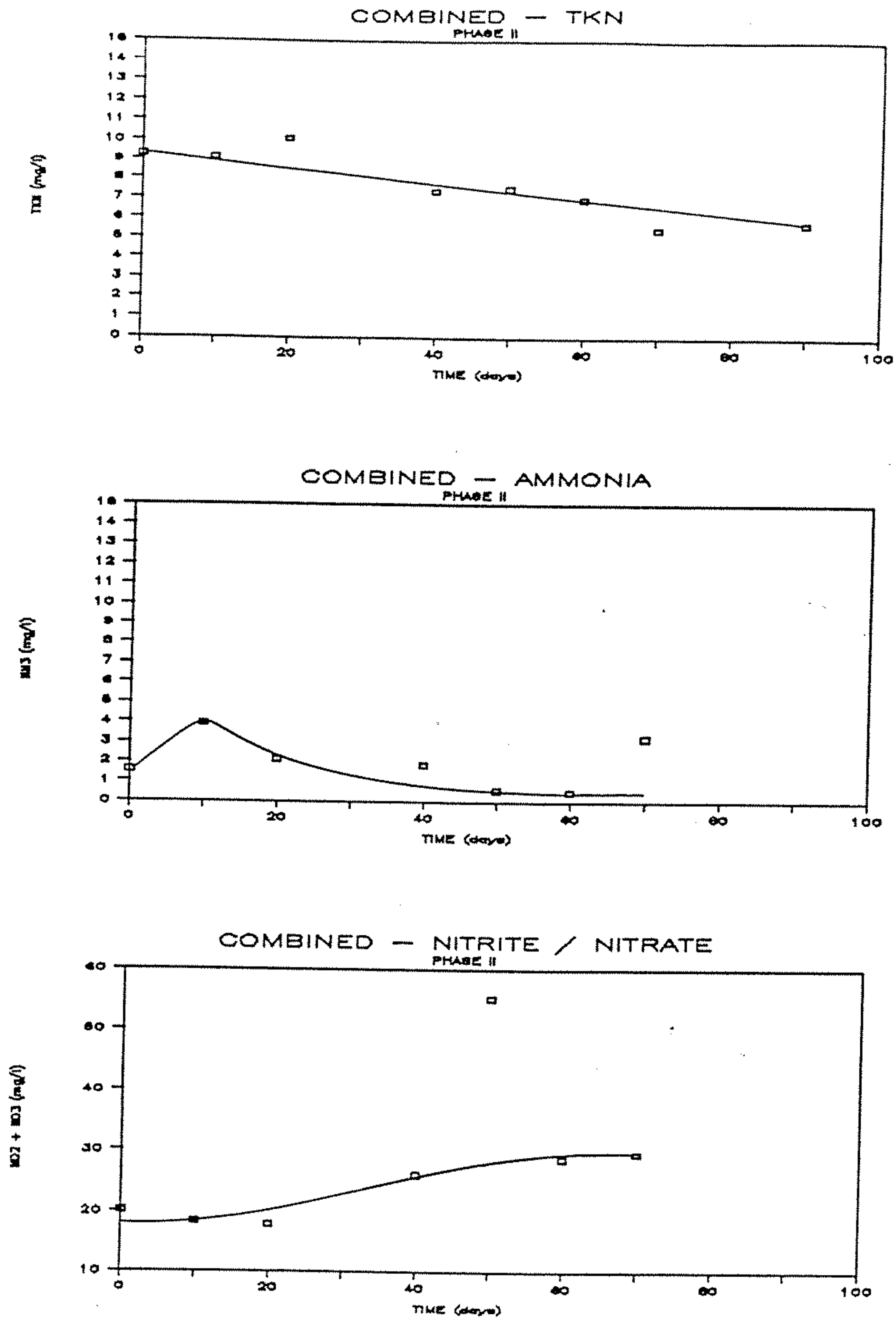


Figure 6: Chronological Variation - Phase II Combined

APPENDIX A

Procedure for Analysis of Non-Biodegradable TKN

PROCEDURE FOR ANALYSIS OF NON-BIODEGRADABLE TKN

I. DILUTION WATER

Dilution water shall be prepared as described below:

Buffer solution prepared according to Standard Methods contains ammonium ion, which would add to the measured nitrogenous BOD. Instead of using that formulation, prepare buffer as follows:

- Add the following reagents to approximately 500 mg of distilled/deionized water and dissolve. Then make up to one liter in a volumetric flask.
- 15.7 g. K_2HPO_4
- 24.1 g. Na_2HPO_4 $7H_2O$
- 11.1 g. KH_2PO_4

This solution should have a pH of 7.2 as prepared.

- Dilution water should be prepared according to Standard Methods, but with substitution of the above buffer.

II. SAMPLE PREPARATION

Prepare sample for analysis consisting of:

A. 1000 ml mill final effluent.

B. 500 ml dilution water.

C. Add commercially available nitrifying seed to culture.

Note: All testing to be performed in duplicate and with a control consisting of glucose-glutamic acid and ammonium chloride.

III. INITIAL ANALYSIS

Analyze mill final effluent for TKN, NO_2/NO_3-N, and NH_3-N.

Analyze dilution water for TKN, NO_2/NO_3-N, and NH_3-N.

Analyze combined sample for pH, TKN, NO_2/NO_3-N, and NH_3-N.

IV. Place sample in 2000 ml flask (as shown in Attachment A), maintain flask at ambient laboratory temperature, maintain under an oxygen blanket for 40 days

V. Prior to aeration, at days 2, 5, 10, 20, 30 and 40, remove 50 ml sample and check pH and dissolved oxygen. The pH will be maintained in the 6.5 to 8.5 range and the dissolved oxygen in excess of 2 mg/l. If, at day 2 or any time low pH and DO levels are found, these will be adjusted and more frequent sampling will be initiated. Do not return sample to flask.

VI. Analyze sample at days 10, 20, 40, and conclusion for TKN, NO_2/NO_3-N, and NH_3-N. The conclusion of the test will be tied into the conclusion of the ultimate BOD test.

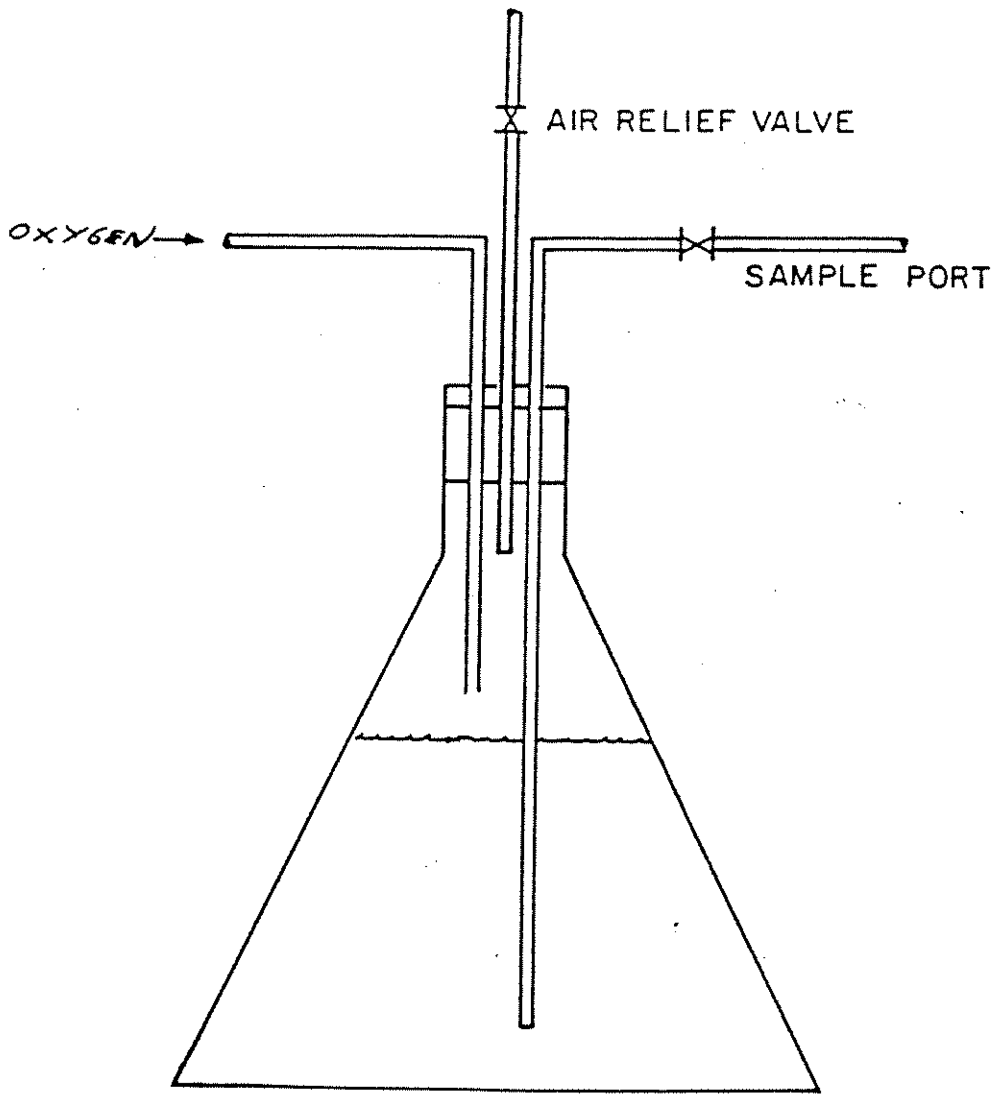
VII. Non-biodegradable TKN percentage is defined as:

$$TKN_R = \frac{TKN_j - TKN_f}{TKN_i}$$

where:

TKN_R = non-biodegradable TKN (Percent)
TKN_i = initial TKN (mg/l)
TKN_f = final TKN (mg/l)

ATTACHMENT A



REFRACTORY TKN TESTING APPARATUS

APPENDIX B

TKN Biodegradation Test Data

PROJECT .: 317-03-35
ANALYSIS BY: ENVIRONMENTAL LABORATORIES
PHASE II. 66 PERCENT KRAFT WASTEWATER

SAMPLE:BIPCO

SAMPLE A

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.19		10.40	11.90	1.58
2	7.20	8.0			
5	7.63	8.0			
10	7.42	9.6	8.67	16.60	1.17
20	7.96	8.0	6.25	16.20	0.80
30					
40	7.76	12.0	6.82	23.40	0.55
50			8.54	28.60	0.23
60	8.04	8.5	7.23	25.90	0.32
70	7.93	7.2	6.22	24.30	0.36
80					
90	8.21	8.1	5.80		

SAMPLE B

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.15		12.40	14.40	1.78
2	7.19	9.4			
5	7.56	9.2			
10	7.37	11.5		14.90	1.04
20	7.83	9.6	7.82	17.30	0.77
30					
40	7.74	12.0	6.94	24.70	0.68
50		6.7	5.41	27.20	0.23
60	8.38	11.5	5.88	28.20	0.29
70	7.98		6.11	24.60	0.35
80					
90	8.20	8.3	6.51		

AVERAGE OF A & B

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.17		11.40	13.15	1.68
2	7.20	8.68			
5	7.60	8.60			
10	7.40	10.55	4.34	15.75	1.11
20	7.90	8.80	7.04	16.75	0.79
30					
40	7.75	12.00	6.88	24.05	0.62
50	0.00	3.35	6.98	27.90	0.23
60	8.21	10.00	6.56	27.05	0.31
70	7.96	3.60	6.17	24.45	0.36
80					
90	8.21	8.20	6.16		

SAMPLE:DOSWELL

SAMPLE A

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.39		1.63	29.40	0.77
2	7.43	10.0			
5	7.60	10.6			
10	7.53	8.6	1.14	28.60	1.80
20	8.11	7.4	0.64	27.90	0.93
30					
40	7.73	12.5	0.93	37.80	0.77
50			0.31	39.00	0.29
60	8.31	9.3	0.40	48.90	0.23
70	8.22	7.9	1.11	41.70	0.69
80					
90	8.21	8.2	0.34		

SAMPLE B

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.28		2.14	24.30	1.88
2	7.27	11.3			
5	7.49	12.0			
10	7.30	14.5	1.20	27.50	1.67
20	8.26	9.2	2.06	27.90	0.82
30					
40	8.30	13.0	0.95	39.00	0.56
50			0.32	37.10	0.32
60	8.11	6.3	0.70	38.60	0.35
70	8.07	7.6	0.49	40.80	0.58
80					
90	8.14	8.2	0.10		

AVERAGE OF A & B

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.34		1.89	26.85	1.33
2	7.35	10.65			
5	7.55	11.30			
10	7.42	11.55	1.17	28.05	1.74
20	8.19	8.28	1.35	27.90	0.88
30					
40	8.02	12.75	0.94	38.40	0.67
50			0.32	38.05	0.31
60	8.21	7.80	0.55	43.75	0.29
70	8.15	7.75	0.80	41.25	0.64
80					
90	8.18	8.20	0.22		

SAMPLE:COMBINED

SAMPLE A

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.18		9.57	21.20	2.12
2	7.19	9.4			
5	7.41	9.4			
10	7.25	10.8	8.46	18.70	3.90
20	7.77	7.6	8.61	17.50	2.17
30					
40	7.54	14.5	7.36	24.90	2.80
50			7.56	53.40	0.68
60	7.84	7.9	6.58	28.90	0.66
70	7.62	7.4	6.46	29.60	0.49
80					
90	8.01	7.9	5.58		

SAMPLE B

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.20		8.93	18.80	1.04
2	7.19	9.0			
5	7.41	8.5			
10	7.20	10.6	9.74	17.80	3.92
20	7.55	8.1	11.49	18.20	2.14
30					
40	7.45	10.5	7.38	27.20	0.94
50			7.53	56.90	0.49
60	7.77	8.5	7.41	28.40	0.38
70	7.85	7.6	4.43	29.40	5.94
80					
90	6.79	8.1	5.93		

AVERAGE OF A & B

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.19		9.25	20.00	1.58
2	7.19	9.20			
5	7.41	8.93			
10	7.23	10.70	9.10	18.25	3.91
20	7.66	7.85	10.05	17.85	2.16
30					
40	7.50	12.50	7.37	26.05	1.87
50			7.55	55.15	0.59
60	7.81	8.20	7.00	28.65	0.52
70	7.74	7.50	5.45	29.50	3.22
80					
90	7.40	8.00	5.76		

PROJEC .: 317-03-35
ANALYSES BY: IRONMENTAL LABORATORIES
66 PERCENT SULFONATION WASTEWATER
PHASE I.

SAMPLE:BIPCO

SAMPLE A

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.17		4.12	0.30	0.15
2	7.36	15.8			
5	7.12	15.1	8.28		
10	7.24	9.6	10.10	<0.02	0.93
20	7.41	7.3		<0.02	2.84
30	7.45	6.8			
40	7.28	10.8	6.46	0.94	0.83
50	7.24	12.7	4.29	3.41	0.20
60	7.30	13.0	3.51	4.48	0.42
70	8.36	8.5	3.98	4.31	0.22
80					
90	8.59	8.0	5.69	5.96	0.38
100			3.14	6.53	0.38
114	8.18	7.3	2.03	5.49	0.11
120					
130	8.17	10.1	4.51	6.76	0.09
140	8.26	11.8	4.12	4.47	
150	8.80	16.5	2.70	5.60	

SAMPLE B

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.18		5.40	0.19	0.15
2	7.90	9.20			
5	7.37	14.60			
10	7.38	8.50	1.44	<0.02	0.43
20	7.31	8.40	8.54	0.07	1.68
30	7.35	6.80			
40	7.28	12.00	6.56	0.85	0.83
50	7.29	14.90	5.83	1.42	0.31
60	7.25	15.10	5.16	2.36	0.28
70	8.47	9.40	6.00	2.50	0.22
80					
90	8.79	9.00	7.16	3.51	0.91
100			5.08	5.99	0.17
114	8.19	7.70	7.78	9.19	<0.02
120					
130	8.15	10.50	3.65	7.00	0.13
140	8.34	12.80	3.83	4.47	
150	8.92	16.00	3.64	5.21	

AVERAGE OF A & B

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.18		4.76	0.25	0.15
2	7.63	12.50			
5	7.25	14.85	4.14		
10	7.31	9.05	5.77		0.68
20	7.36	7.85	4.27	0.04	2.26
30	7.40	6.80			
40	7.28	11.40	6.51	0.90	0.83
50	7.27	13.80	5.06	2.42	0.26
60	7.28	14.05	4.34	3.42	0.35
70	8.42	8.95	4.99	3.41	0.22
80					
90	8.69	8.50	6.43	4.74	0.65
100			4.11	6.26	0.28
114	8.19	7.50	4.91	7.34	0.06
120					
130	8.16	10.30	4.08	6.88	0.11
140	8.30	12.30	3.98	4.47	
150	8.86	16.25	3.17	5.41	

SAMPLE:DOSWELL

SAMPLE A

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.25		5.54	14.66	2.01
2	7.69	16.50			
5	7.56	16.80			
10	7.60	9.60	6.02	1.25	3.08
20	6.90	8.80	1.75	12.50	0.55
30	7.24	7.18			
40	7.40	12.70	1.09	14.40	0.25
50	7.33	14.40	1.12	20.95	0.29
60	7.30	14.50	<0.10	18.29	0.27
70	8.58	7.10	<0.10	22.40	0.23
80					
90	8.10	13.50	0.68	41.60	0.24
100			0.38	26.00	0.65
114	8.15	7.80	0.53	18.03	0.15
120					
130	7.66	10.30	0.52	24.00	0.08
140	8.22	12.00	0.81	15.20	
150	8.84	18.50	0.53	17.50	

SAMPLE B

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.22		6.09	12.73	1.95
2	7.14	6.80			
5	6.82	10.40			
10	7.00	10.20	5.15	7.75	3.36
20	6.50	11.10	2.47	9.89	1.25
30	6.83	7.40			
40	7.08	12.00	1.20	14.40	0.17
50					
60					
70					
80					
90					
100			CONTAMINATED		
114					
120					
130					
140					
150					

AVERAGE OF A & B

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.24		5.82	13.70	1.98
2	7.42	11.65			
5	7.19	13.60			
10	7.30	9.90	5.59	4.50	3.22
20	6.70	9.95	2.11	11.20	0.90
30	7.04	7.29			
40	7.24	12.35	1.15	14.40	0.21
50					
60					
70					
80					
90					
100					
114					
120					
130					
140					
150					

SAMPLE:COMBINED

SAMPLE A

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.26		6.30	2.18	0.81
2	7.42	15.00			
5	7.28	13.40			
10	7.36	10.10	4.60	0.52	1.18
20	7.29	8.30	7.49	1.02	2.24
30	7.23	6.80			
40	7.24	11.00	5.49	0.20	0.36
50	7.33	11.90	4.84	4.29	
60	7.40	11.50	1.49	6.04	
70	8.57	7.90	5.04	6.22	
80					
90	9.04	8.40	7.25	8.48	0.20
100			6.77	14.32	0.46
114	8.20	9.70	7.04	9.99	0.23
120					
130	8.12	10.90	4.11	12.83	0.28
140	8.35	12.50	4.91	8.65	
150	9.11	13.50	7.11	NA	

SAMPLE B

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.23		6.01	2.16	0.69
2	7.47	14.20			
5	7.26	15.80			
10	7.27	9.80	6.12	0.46	1.52
20	7.08	10.20	7.39	0.81	1.23
30	7.13	6.73			
40	7.26	13.50	6.02		0.14
50	7.36	13.30	5.26	3.79	
60	7.43	13.20	5.79	4.56	
70	8.46	9.60	5.79	4.16	
80					
90	8.43	9.50	7.50	5.33	0.41
100			5.20	7.73	0.19
114	8.17	7.70	4.34	<.02	0.15
120					
130	8.19	10.70	4.04	9.50	0.15
140	8.33	12.00	3.25	6.29	
150	8.74	16.50	3.91	7.49	

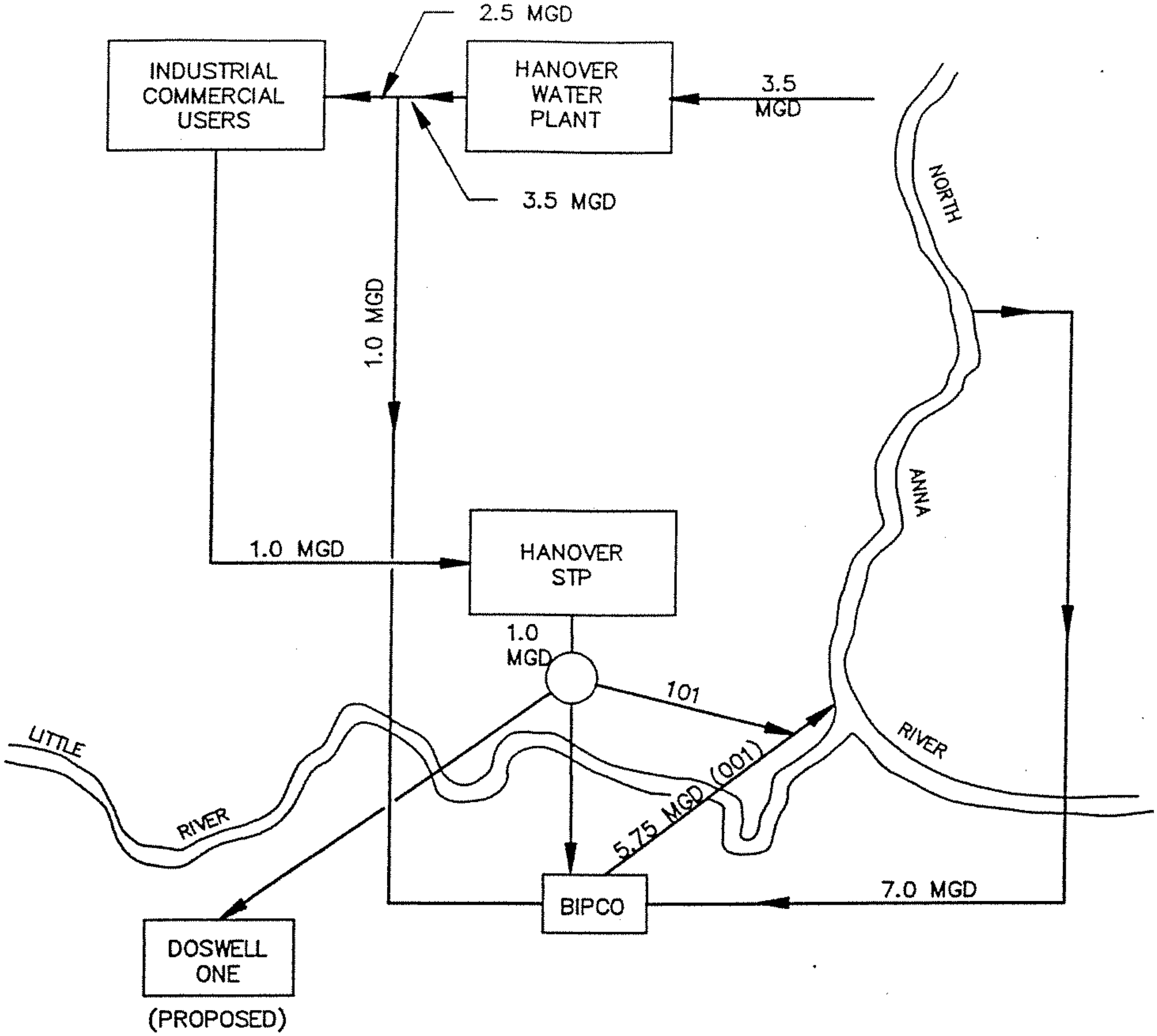
AVERAGE OF A & B

TIME DAYS	pH	DO mg/l	TKN mg/l	NO2/NO3-N mg/l	NH3-N mg/l
0	7.25		6.16	2.17	0.75
2	7.45	14.60			
5	7.27	14.60			
10	7.32	9.95	5.36	0.49	1.35
20	7.19	9.25	7.44	0.92	1.74
30	7.18	6.77			
40	7.25	12.25	5.76	0.10	0.25
50	7.35	12.60	5.05	4.04	
60	7.42	12.35	3.64	5.30	
70	8.52	8.75	5.42	5.19	
80					
90	8.74	8.95	7.38	6.91	0.31
100			5.99	11.03	0.33
114	8.19	8.70	5.69	5.00	0.19
120					
130	8.16	10.80	4.08	11.17	0.22
140	8.34	12.25	4.08	7.47	0.00
150	8.93	15.00	5.51	3.75	0.00

Attachment 12

Three schematics that address the proposed mill expansion at Bear Island are attached:

1. Overall water flow schematic reflecting the Bear Island mill expansion
2. Proposed upgrade of wastewater treatment facilities at Bear Island
3. Detail of proposed effluent oxygenation



NOTE: THE 1.0 MGD EFFLUENT FROM THE COUNTY WWTP CAN BE DISPOSED THROUGH ANY OF THE 3 ROUTES (OR COMBINATION THEREOF):

A) TO DOSWELL ONE: 0.4 TO 1.0 MGD

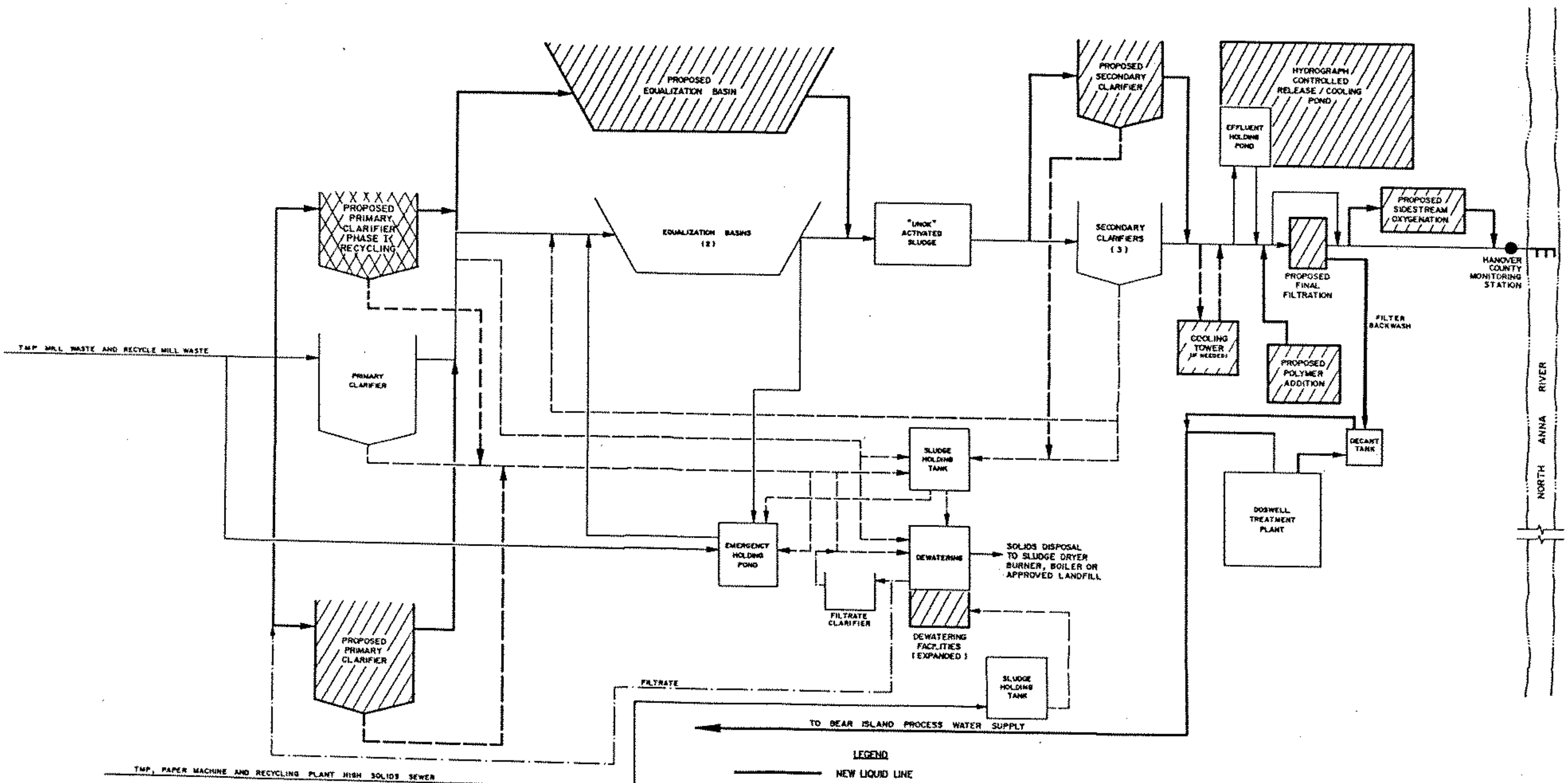
B) TO BIPCO: 0.2 TO 1.0 MGD

C) TO THE RIVER THROUGH OUTFALLS 101–001: 0.0 TO 1.0 MGD IN CASE BOTH DOSWELL ONE AND BIPCO ARE NOT OPERATIONAL.

PROJECT WATER WITHDRAWAL

BEAR ISLAND PAPER COMPANY, L.P.
ASHLAND, VIRGINIA

SCALE NOT TO SCALE	APPROVED BY :	DRAWN BY: D.A.O.
DATE MAY 1994	DESIGNED BY :	REVISED
PROJECT NUMBER		DRAWING NO.



LEGEND

- NEW LIQUID LINE
- NEW SLUDGE LINE
- EXISTING LIQUID LINE
- EXISTING SLUDGE LINE
- EXISTING FILTRATE LINE
- PROPOSED CONSTRUCTION
- PROPOSED EFFLUENT DIFFUSER

PROPOSED PLANT SCHEMATIC

BEAR ISLAND PAPER COMPANY
WASTEWATER TREATMENT PLANT

N.T.S.
DEC. 28, 1989
AWARE INC.
N 106-01

NO.	DATE	REVISIONS	MADE	APPROVED
4	3/2/93	ADDED DECANT TANK	DAD	GPT
3	11/5/90	Added Sludge Holding Tank	DGY	RS
2	8/23/90	Added Filtrate Clarifier Line	DGY	RS
1	1/4/90	Modified Cooling Tower	TKS	GPT

FILE NAME: 10601p01 (08-13-93)

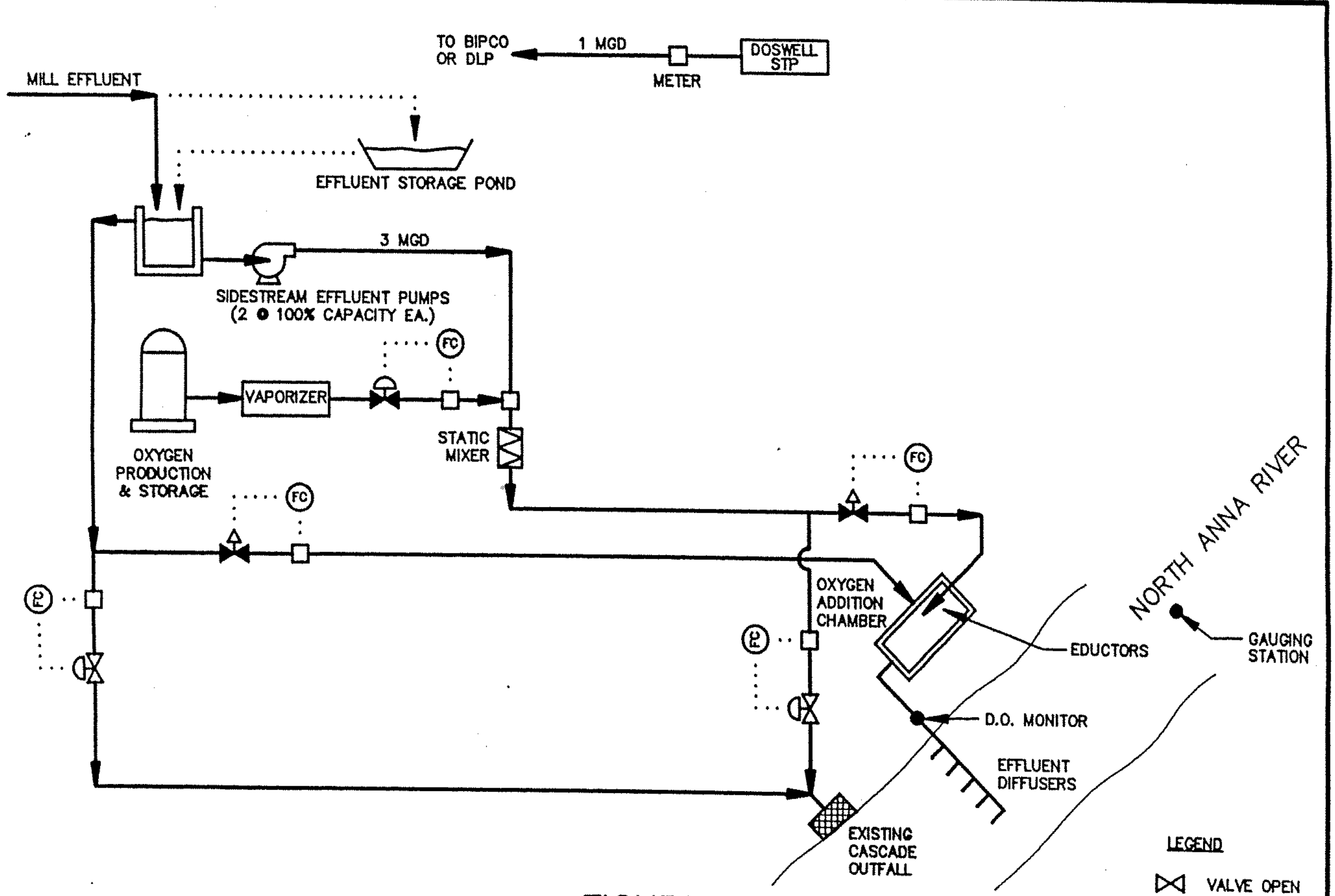


FIGURE 2

CONCEPTUAL LAYOUT OF OXYGENATION SYSTEM

NOT TO SCALE

Attachment 13

Attachment 13 includes Attachments 13A and 13B. **Attachment 13A** develops the control equation for a mill expansion consisting only of a second, TMP paper line. As the mill now uses recycled paper, and therefore, the expansion would also use recycled paper (approximately 40% recycled newsprint), the control equation was reevaluated in regard to the larger water use associated with recycled paper. **Attachment 13B** discusses those revisions. As it turns out, the control equation remained the same, but the dissolved oxygen requirements changed.

Attachment 13A

SECTION 7.0
1987 MODEL SIMULATIONS

Computer simulations were performed using various input conditions to define the capacity of the river to assimulate wastewater in compliance with the SWCB anti-degradation policy. All model simulations used the calibrated model presented in Section 5.0.

7.1 General Aproach

The modeling for the proposed mill expansion uses the same approach as previous models of the North Anna, except that this model uses the actual stream data to define model parameters and input conditions (Section 3.0). The model was used to evaluate discharge at the wasteload allocation defined in the York River Plan (690 lbs $CBOD_5$ per day). The allowable in-stream UCBOD of the wastewater was then used in the mass balance equation (of the wastewater-river mix) to define effluent limits, which can be expressed in terms of an effluent limitation control equation.

The modeling analysis and controls for the proposed mill expansion have been based on the ultimate and 5-day carbonaceous BOD. The 16th edition of Standard Methods for the Analysis of Water and Wastewater (Greenberg et al, 1985) has introduced a procedure for carbonaceous analysis as the method to differentiate $CBOD_5$ and nitrogenous oxygen demand.

For this modeling analysis, the South Anna River DO is given as a function of the temperature of the North Anna River, as developed from probability distributions of DO data collected by Hanover County since 1982. For example, for days when the North Anna temperature was 25^{o}C, the 90th percentile DO in the South Anna River was 6.46 mg/l (Figure 6-5). The measured 90th percentile South Anna DO values are presented as a function of North Anna temperature in Figure 7-1. (The DO is related to the North Anna temperature, since the North Anna temperature is the critical temperature for the modeling.) A relationship function which may be used to estimate the 90th percentile DO from a given North Anna temperature is

$$SA\ DO\ 90 = 12.97 - 0.4058\ (NA\ TEMP) + 0.005734\ (NA\ TEMP)^2 \quad (7\text{-}1)$$

where

SA DO 90 = 90th percentile South Anna DO (mg/l),

NA TEMP = North Anna temperature (^{o}C).

From this function, the South Anna DO input condition may be obtained for any North Anna temperature.

A summary of model parameters and input conditions which have been used in the model simulations is presented in Table 7-1.

The model was used to determine the allowable $CBOD_5$ loadings and the required initial in-stream DO concentrations which would meet the SWCB anti-degradation policy. It was anticipated that supplemental effluent oxygenation would be required under certain conditions to attain the necessary in-stream DO mix.

7.2 Oxygenation of Effluent

Applying Henry's Law to a water column in the presence of an oxygen-containing gas, the equilibrium DO in the water is directly proportional to the partial pressure of oxygen in the overlying gas. This may be expressed as

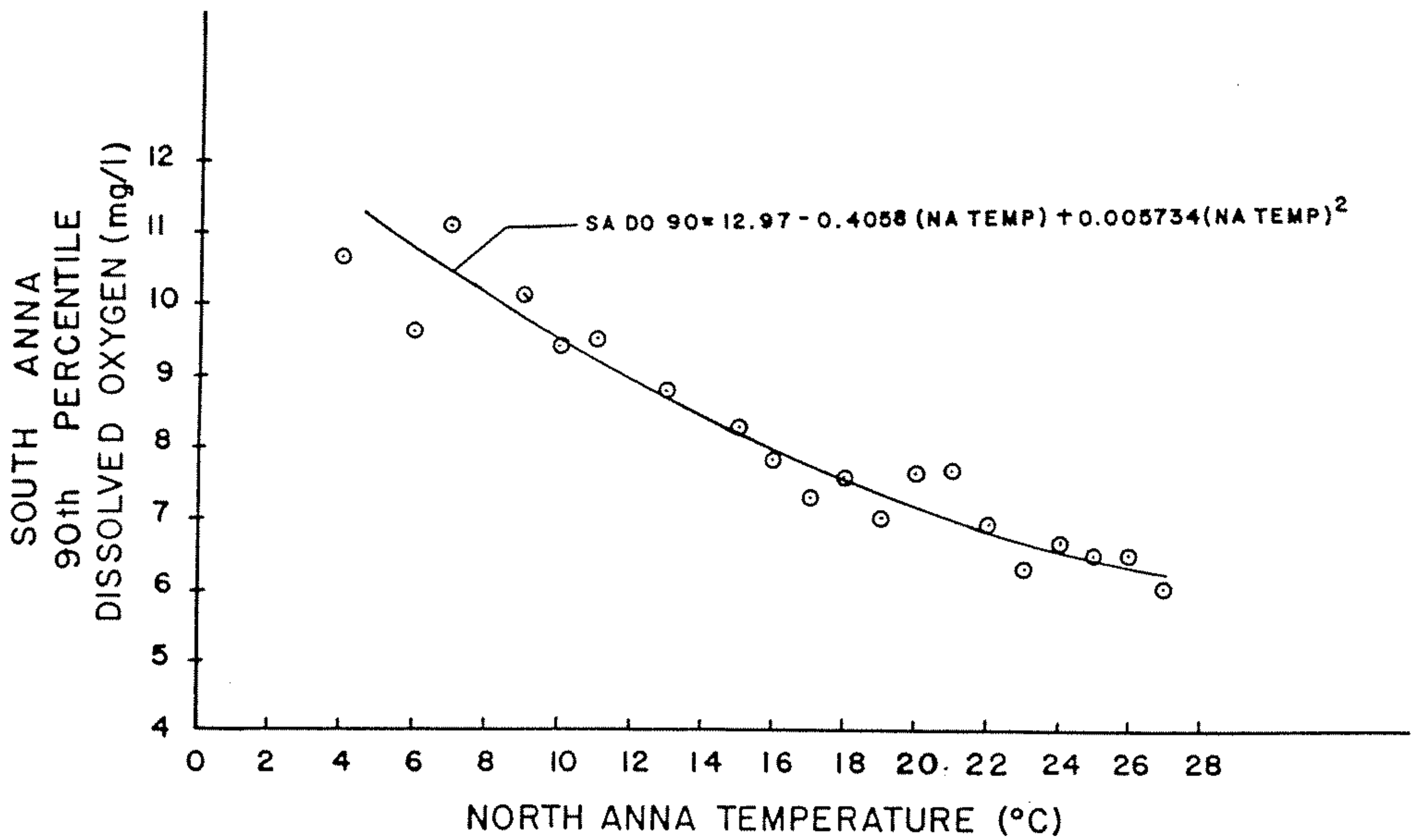


FIGURE 7-1. THE 90TH PERCENTILE SOUTH ANNA DISSOLVED OXYGEN VS. NORTH ANNA TEMPERATURE.

TABLE 7-1

MODEL PARAMETERS AND INPUT CONDITIONS

Model Parameters: Reaction Rates (20°C)

Stream Reach	K_1-20°C	K_2-20°C	K_N-20°C	$SOD_{20°C}$
1	0.11	1.30	0.30	5.0
2	0.11	1.00	0.20	2.0
3	0.11	1.90	0.20	1.8
4	0.10	2.00	0.20	2.5
5	0.10	2.50	0.20	1.5

Model Input Conditions		Justification
TKN Doswell	10 mg/l	Section 6.4; Appendix J
Flow Doswell	4.5 MGD	Anticipated flow after expansion
Water Withdrawal	10.5 MGD	Section 6.3
Headwater $CBOD_u$	4.2 mg/l	Average (Aug. 19, Oct. 13 & 15)
Headwater TKN	0.4 mg/l	Average (Aug. 19, Oct. 13 & 15)
Little River $CBOD_u$	2.5 mg/l	Average (Oct. 13, Oct. 15)
Little River TKN	0.5 mg/l	Average (Oct. 13, Oct. 15)
South Anna $CBOD_u$	3.6 mg/l	Average (Aug. 19, Oct. 13 & 15)
South Anna TKN	0.50 mg/l	Average (Aug. 19, Oct. 13 & 15)
South Anna DO	12.97 - 0.4058 (NA TEMP) + 0.005734 $(\text{NA TEMP})^2$ where NA temp = North Anna temperature (°C). (This is equation 7-1.)	

$$C_s = \frac{1}{H_e'} P_o$$

where

C_s = saturated DO (mg/l),

H_e' = Henry's Constant (atm-l/mg),

P_o = partial pressure of oxygen (atm).

For example, for water at 20°C in the presence of atmospheric air, H_e' = 0.023 atm-l/mg, P_o = 0.209 atm, and C_s = 9.09 mg/l.

At a given temperature, the equilibrium DO increases with increasing partial pressure of the oxygen in the overlying gas. This may be accomplished by (1) increasing the percentage of oxygen in the overlying gas, and/or (2) increasing the gage pressure of the oxygen-containing gas. For example, replacing atmospheric air (P_o = 0.209 atm) with pure oxygen (P_o = 1.0 atm) would result in a saturated DO of C_s = 43.47 mg/l at 20°C and standard atmospheric pressure.

A number of papers pertaining to post-aeration are presented in Appendix M.

7.3 Deaeration Under Supersaturated Conditions

According to Thomann and Mueller (1987), the transfer of a chemical across the air-water interface at atmospheric pressure may be derived from

$$V \frac{dC}{dt} = k_l A \left(\frac{C_g}{H_e} - fC\right) \tag{7-2}$$

where

V = volume of water column (L^3),

C = chemical concentration in the water column (M/L^3),

t = time (T),

k_l = overall exchange coefficient (L/T),

A = surface area (L^2),

C_g = chemical concentration in the overlying air (M/L^3),

H_e = Henry's constant,

f = fraction of total chemical which is dissolved.

The equation shows that flux of a chemical may be from the air to the water (if C_g/H_e is greater than fC) or from the water to the air (if fC is greater than C_g/H_e). Application of the two-film theory results in the overall transfer coefficiency being given as

$$\frac{1}{k_l} = \frac{1}{K_l} + \frac{1}{K_g H_e} \tag{7-3}$$

where

K_l = liquid film coefficient (L/T),

K_g = gas film coefficient (L/T).

This theory may be applied to the transfer of oxygen across an air-water interface. In such case, C_g/H_e is the saturated DO concentration and $f = 1$. Since H_e is relatively high, the oxygen transfer rate is controlled by the liquid phase. The reaeration coefficient is given by

$$K_2 = \frac{k_l A}{V} \tag{7-4}$$

where K_2 is the atmospheric reaeration coefficient (T^{-1}). Thus, for oxygen transfer, equation 7-2 may be written as

$$\frac{dC}{dt} = K_2 \, (C_s - C) \tag{7-5}$$

where C_s is the saturated DO concentration (M/L^3). As with equation 7-2, the solution to equation 7-5 does not depend on the sign of the right-hand side. In terms of DO deficit, the solution is given by

$$D = D_0 \exp(-K_2 t) \tag{7-6}$$

where

$D = C_s - C$ = oxygen deficit (M/L^3),

D_0 = initial oxygen deficit (M/L^3)

Since equation 7-2 is applicable to mass flow in either direction, it follows that equation 7-6 is appropriate for both reaeration and deaeration.

Similarly, equation 3-1 may be applied to supersaturated water, although there are some important assumptions involved. First, it must be assumed that the CBOD and NBOD decay processes are not affected by the existance of supersaturated conditions. Also, it must be assumed that SOD will not be affected by the additional oxygen. The use of equation 3-1 to evaluate supersaturated conditions is a common practice (Thomann, 1987).

A number of papers pertaining to post-aeration and deaeration under supersaturated conditions are presented in Appendix M.

7.4 Model Simulations

The calibrated Streeter-Phelps model (as described in Section 5.0) indicates that a natural DO sag would exist in the North Anna River. Therefore, the upstream dissolved oxygen concentrations are adjusted to maintain the critical river DO at the sag location. The DO concentrations required at NA-3.5 to maintain the critical background DO throughout the North Anna River are presented in Table 7-2 for each season. The modeling used to develop these required DO levels was based on critical temperatures, 7Q10 flow, and upstream CBOD and TKN values measured during the data acquisition phase of this study (Table 7-1).

7.4.1 Model Simulations for Spring Season

For the months of April, May, and June, the critical temperature is 24°C and the critical background DO is 6.43 mg/l (Table 7-2). The model indicates that the minimum DO of 6.23 mg/l (6.43 mg/l minus 0.2 mg/l) can be maintained at 7Q10 flow in the North Anna River for an initial in-stream $UCBOD_5$ mix of 20.04 mg/l (4.5 MGD and 690 lbs $CBOD_5$ per day), if the initial in-stream DO mix is 11.70 mg/l (Figure 7-2). For an upstream DO of 7.90 mg/l (Table 7-2), this requires effluent oxygenation to a concentration of 27 mg/l, based on a mass balance at the discharge point.

The model indicates that with the maximum mill discharge (5.4 MGD and 1,350 lbs $CBOD_5$ per day), a North Anna flow of 92.73 cfs, and an upstream DO of 7.90 mg/l; the minimum DO of 6.23 mg/l can be maintained in the North Anna River without supplemental effluent oxygenation (Figure 7-3).

The model indicates that with the maximum combined discharge of the mill and the storage ponds (21.2 MGD and 5,300 lbs $CBOD_5$ per day), a North Anna flow of 218.73 cfs, and an upstream DO of 7.90

TABLE 7-2

SUMMARY OF EFFLUENT OXYGENATION REQUIREMENTS AND ALLOWABLE DISCHARGES

Line		Spring	Summer	Fall	Winter
1	Critical Temperature (^{o}C)	24	27	16	11
2	Critical DO (mg/l)	6.43	5.97	7.87	8.91
3	Initial DO to maintain critical DO throughout North Anna for no effluent at critical temperature and 7Q10 flow (mg/l)[a]	7.90	7.73	8.75	9.31
4	Minimum DO (mg/l)[b]	6.23	5.77	7.67	8.71
5	Initial in-stream DO required at 7Q10 flow and discharge of 690 lbs $CBOD_5$ per day to maintain minimum DO (Line 4) throughout the North Anna (mg/l)[c]	11.70	12.65	10.50	9.93
6	Effluent O_2 requirement at 7Q10 flow and discharge of 690 lbs per day, based on an upstream DO in the North Anna equal to Line 3 (mg/l)[c]	27	32	17	12
7	North Anna flow above which no O_2 is required (cfs):[c]				
7(a)	Discharge = 1,350 lbs $CBOD_5$ per day	92.73	97.73	86.73	79.73
7(b)	Discharge = 5,300 lbs $CBOD_5$ per day	218.73	222.73	195.73	175.73

[a] From modeling (Appendix I)

[b] Critical DO minus 0.2 mg/l.

[c] Sections 7.4.1 through 7.4.4.

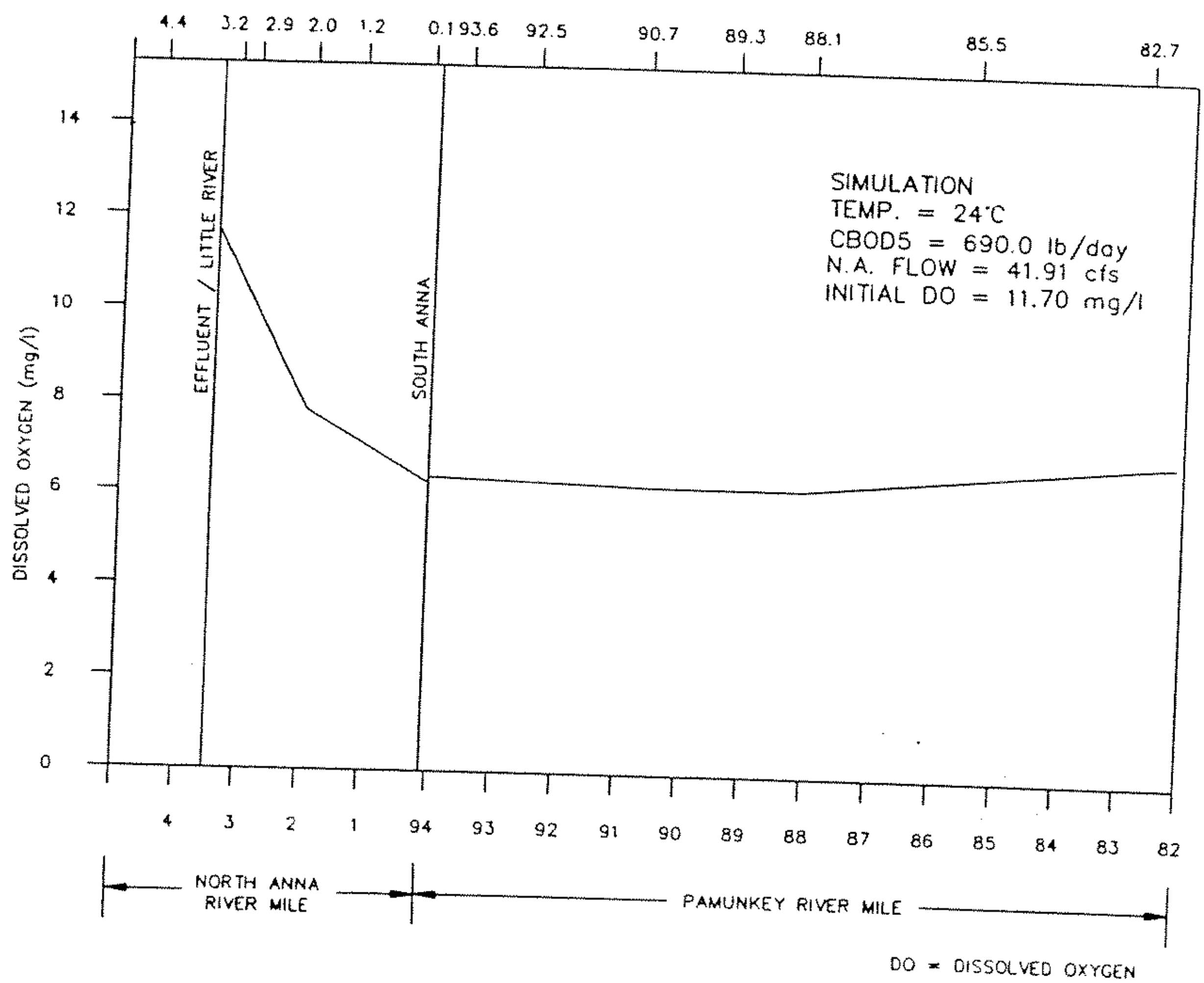


FIGURE 7-2. DISSOLVED OXYGEN PROFILE FOR 7Q10 FLOW, TEMPERATURE OF 24°C INITIAL UCBOD OF 20.04 MG/L, AND INITIAL DISSOLVED OXYGEN OF 11.70 MG/L.

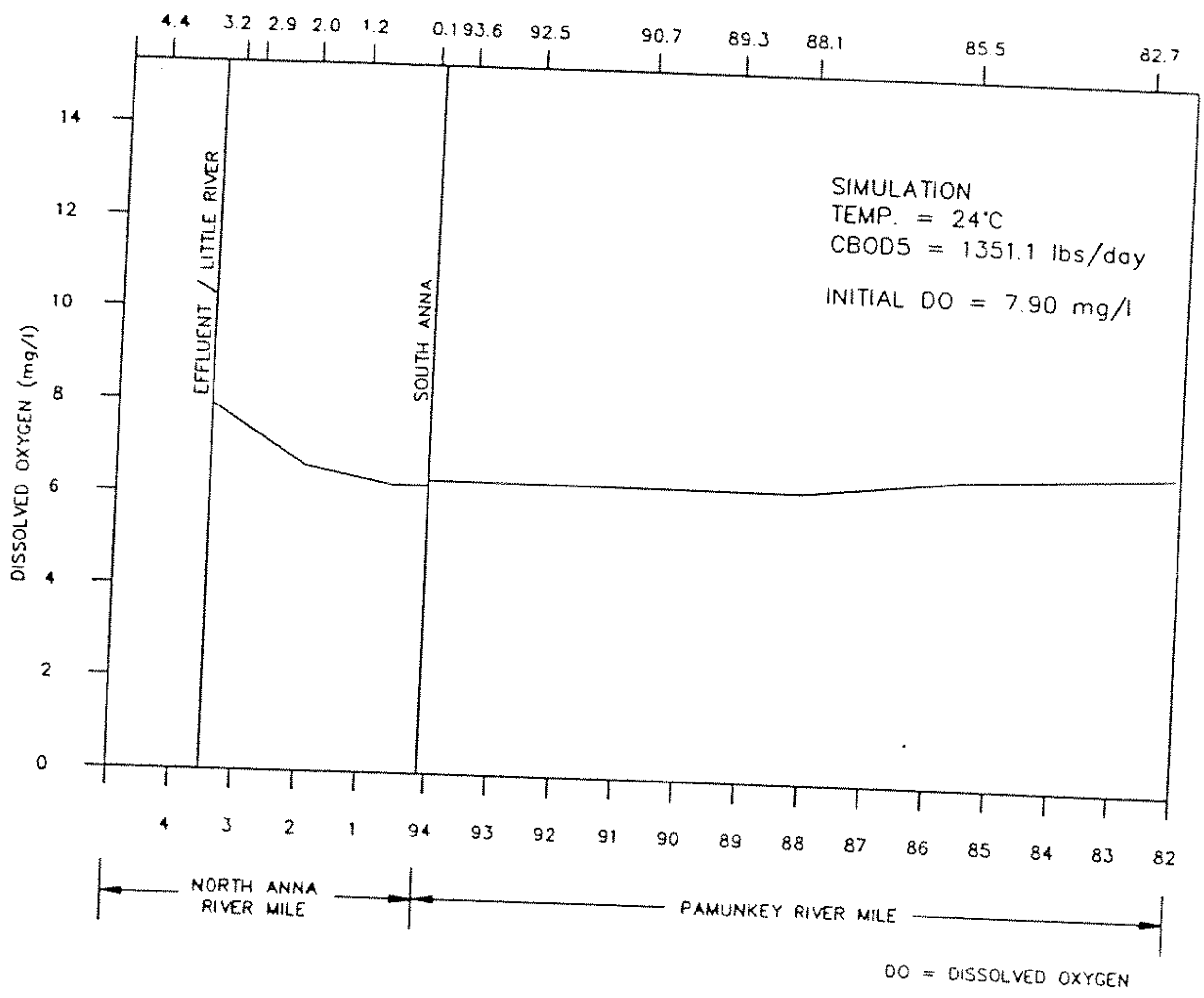


FIGURE 7-3. DISSOLVED OXYGEN PROFILE FOR FLOW OF 92.73 CFS, TEMPERATURE OF 24°C INITIAL UCBOD OF 14.48 MG/L, AND INITIAL DISSOLVED OXYGEN OF 7.90 MG/L.

mg/l; the minimum DO of 6.23 mg/l can be maintained without supplemental effluent oxygenation (Figure 7-4).

7.4.2 Model Simulation For Summer Season

For the months of July, August, and September, the critical temperature is 27°C and the critical background DO is 5.97 mg/l (Table 7-2). The model indicates that the minimuim DO of 5.77 mg/l (5.97 mg/l minus 0.2 mg/l) can be maintained at 7Q10 flow in the North Anna River for an initial in-stream UCBOD mix of 20.04 mg/l (4.5 MGD and 690 lbs $CBOD_5$ per day), if the initial in-stream DO mix is 12.65 mg/l. For an upstream DO of 7.73 mg/l (Table 7-2), this requires effluent oxygenation to a concentration of 32 mg/l, based on a mass balance at the discharge point.

The model indicates that with the maximum mill discharge, a North Anna flow of 97.7 cfs, and an upstream DO of 7.73 mg/l; the minimum DO of 5.77 mg/l can be maintained in the North Anna River without supplemental effluent oxygenation.

The model indicates that with the maximum combined discharge of the mill and the storage ponds, a North Anna flow of 222.7 cfs, and an upstream DO of 7.73 mg/l; the minimum DO of 5.77 mg/l can be maintained without supplemental effluent oxygenation.

7.4.3 Model Simulation For Fall Season

For the months of October, November, and December, the critical temperature is 16°C and the critical background DO is 7.87 mg/l (Table 7-2). The model indicates that the minimuim DO of 7.67 mg/l (7.87 mg/l

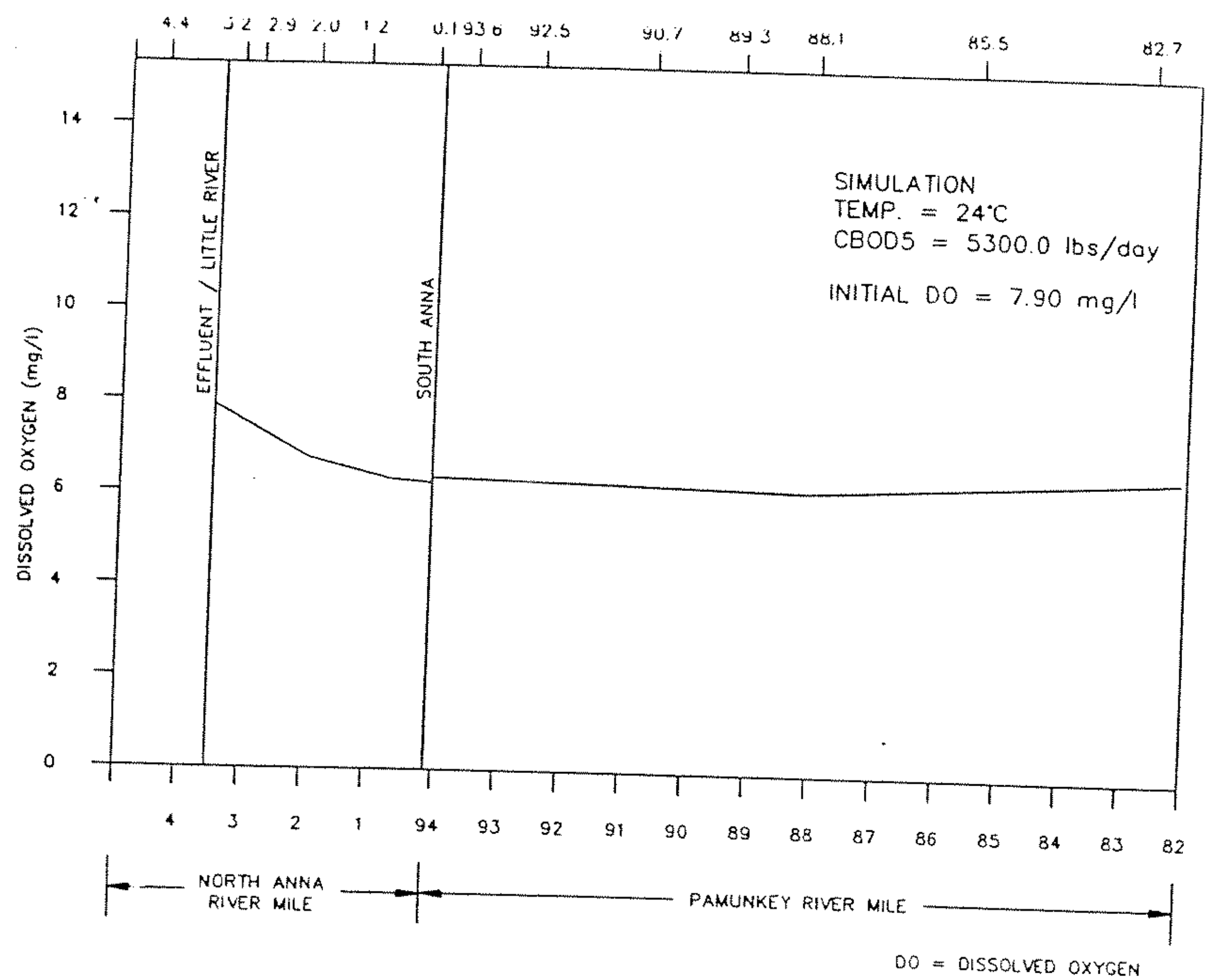


FIGURE 7-4. DISSOLVED OXYGEN PROFILE FOR FLOW OF 218.7 CFS, TEMPERATURE OF 24°C INITIAL UCBOD OF 20.56 MG/L, AND INITIAL DISSOLVED OXYGEN OF 7.90 MG/L.

minus 0.2 mg/l) can be maintained at 7Q10 flow in the North Anna River for an initial in-stream UCBOD mix of 20.04 mg/l (4.5 MGD and 690 lbs $CBOD_5$ per day), if the initial in-stream DO mix is 10.50 mg/l. For an upstream DO of 8.75 mg/l (Table 7-2), this requires effluent oxygenation to a concentration of 17 mg/l, based on a mass balance at the discharge point.

The model indicates that with the maximum mill discharge, a North Anna flow of 86.7 cfs, and an upstream DO of 8.75 mg/l; the minimum DO of 7.67 mg/l can be maintained in the North Anna River without supplemental effluent oxygenation.

The model indicates that with the maximum combined discharge of the mill and the storage ponds, a North Anna flow of 195.7 cfs, and an upstream DO of 8.75 mg/l; the minimum DO of 7.67 mg/l can be maintained without supplemental effluent oxygenation.

7.4.4 Model Simulation For Winter Season

For the months of January, February, and March, the critical temperature is 11^oC and the critical background DO is 8.91 mg/l (Table 7-2). At the critical temperature of 11^oC, it was assumed that the NBOD deoxygenation coefficient (K_N) is equal to zero. The model indicates that the minimuim DO of 8.71 mg/l (8.91 mg/l minus 0.2 mg/l) can be maintained at 7Q10 flow in the North Anna River for an initial in-stream UCBOD mix of 20.04 mg/l (4.5 MGD and 690 lbs $CBOD_5$ per day), if the initial in-stream DO mix is 9.93 mg/l. For an upstream DO of 9.31 mg/l (Table 7-2), this requires effluent oxygenation to a concentration of 12 mg/l, based on a mass balance at the discharge point.

The model indicates that with the maximum mill discharge, a North Anna flow of 79.7 cfs, and an upstream DO of 9.31 mg/l; the minimum DO of 8.71 mg/l can be maintained in the North Anna River without supplemental effluent oxygenation.

The model indicates that for the maximum combined discharge of the mill and the storage ponds, a North Anna flow of 175.7 cfs, and an upstream DO of 9.31 mg/l, the minimum DO of 8.71 mg/l can be maintained without supplemental effluent oxygenation.

7.4.5 Summary

The allowable $CBOD_5$ discharges and effluent oxygenation requirements are summarized in Table 7-3.

TABLE 7-3

SUMMARY OF EFFLUENT OXYGENATION REQUIREMENTS

	Spring	Summer	Fall	Winter
Critical Temperature (^oC)	24	27	16	11
Effluent O_2 requirement (mg/l)	27	32	17	12
North Anna flow above which no O_2 is required (cfs):				
a. Normal mill discharge	92.73	97.73	86.73	79.73
b. Normal mill discharge plus release from hydrograph-controlled release pond	218.73	222.73	195.73	175.73

SECTION 8.0

PROPOSED NPDES CRITERIA

The proposed NPDES criteria are based on maintaining the SWCB anti-degradation policy in the North Anna River. The results of the modeling indicate that the addition of oxygen to the effluent using pure oxygen is required when the river flow is less than 100 cfs and there is no discharge from the hydrograph-controlled release lagoon, and up to river flow of 235 cfs when there is a discharge from the hydrograph-controlled release lagoon. A cascade type aeration system, similar to the existing unit, will be used in all other discharge cases.

8.1 Allowable CBOD

The current permit has a control equation which regulates the allowable effluent discharge in proportion to the river flow. At higher stream flows, the allowable discharge is increased. The control equation has been updated based on the results of the modeling (Table 7-2).

The control equation is based on solving a mass balance around the UCBOD mix in the river. The results of the modeling indicated a critical UCBOD mix in the river of 20.04 mg/l. The control equation will define allowable discharge $CBOD_5$ in lbs/day. The basic mass balance is:

Input Load (North Anna - Withdrawal + Little River + Effluent) = UCBOD mix in river (8-1)

$$\frac{(Q_u - Q_w)\ (4.2) + (1.77)\ (2.5) + (6.98)\ S_o\ (8.34)}{Q_u - Q_w + 1.77 + 6.98} = 20.04$$

where

Q_u = stream flow in North Anna River before withdrawal (cfs),

Q_W = withdrawal from North Anna (cfs),

S_o = UCBOD of effluent (mg/l).

The allowable $CBOD_5$ discharge in lb/day can be defined as

$$\text{Allowable CBOD5} = \frac{S_o}{F} (QD)\ 8.34$$

where

$F = CBOD_u/CBOD_5$,

Q_D = effluent discharge flow (MGD).

This mass balance is solved for allowable $CBOD_5$, based on monitoring of the North Anna River flow at the Doswell discharge gage. Hanover County would initiate continuous monitoring of the flow in the river, which could be accomplished by telemetry from a gaging station located immediately upstream (approximately within 100 ft) of the effluent discharge (Figure 2.2). A typical cross section of this gaging location during low-flow conditions is presented in Figure 8-1. A gaging station at this location would allow measurement of the actual flow in the river.

The proposed effluent criteria would be defined by the following control equation:

$$\text{Allowable } CBOD_5 = 18.97\, Q_s + 204.77 \qquad (8\text{-}2)$$

where Q_s = stream flow in North Anna River after withdrawal.

The derivation of this equation from the mass balance is presented in Table 8-1. This control equation would be valid under all conditions. This equation would apply for all temperatures up to a maximum $CBOD_5$ level of 5,300 lb/day. A graphical interpretation of equation 8-2 is presented in Figure 8-2.

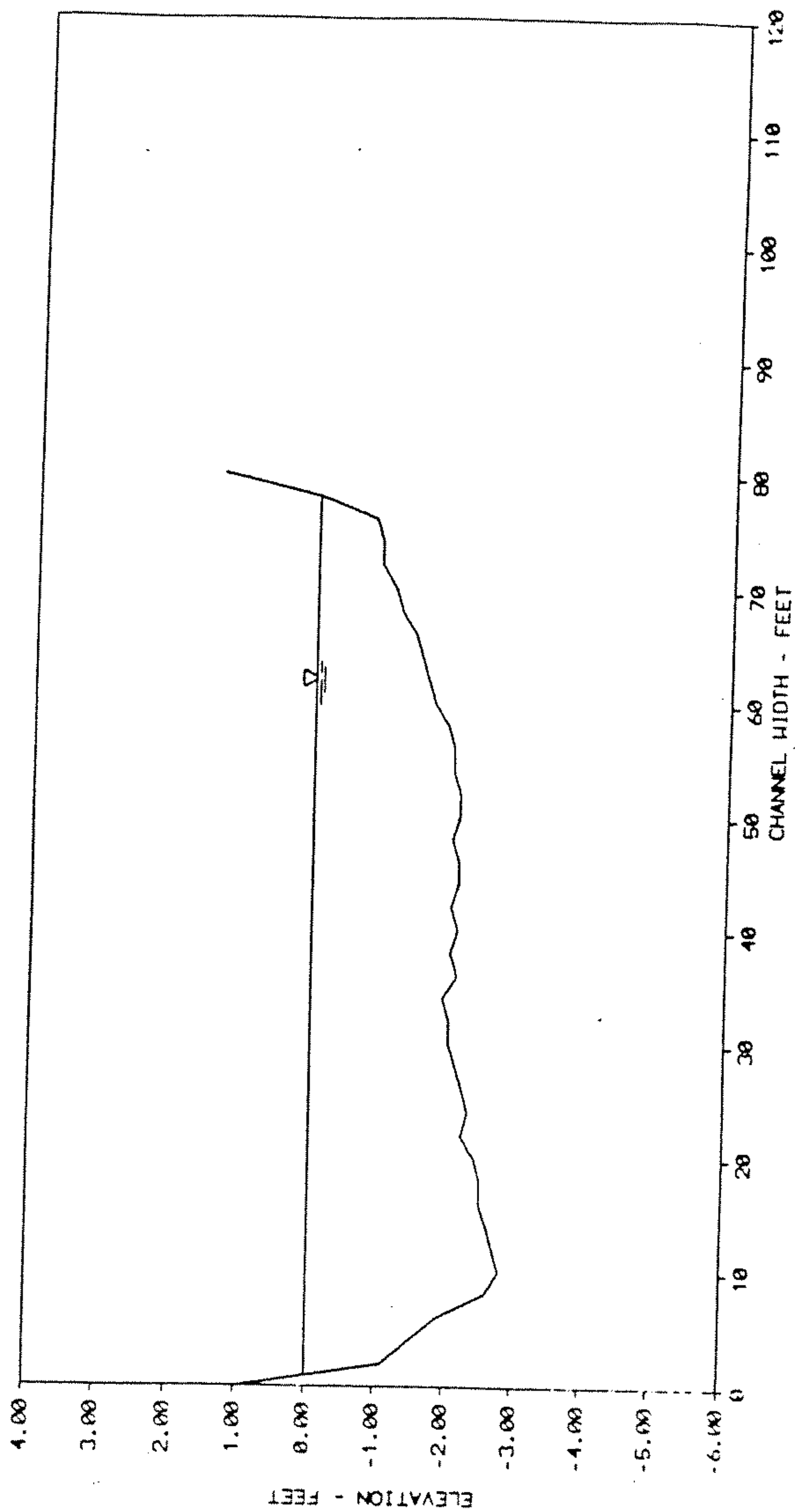


FIGURE 8-1. TYPICAL CROSS SECTION OF PROPOSED GAGING STATION

TABLE 8-1

DERIVATION OF CONTROL EQUATION

The mass balance of (In-stream $CBOD_u$ Mix = Input Flow) is solved:

$$\text{In-stream UCBOD Mix} = \frac{(Q_S)(CBOD_{u1}) + (Q_{LR})(CBOD_{u2}) + Q_D(S_o)}{Q_S + Q_{LR} + Q_D} \quad (1)$$

where

Input Load = (North Anna - withdrawal + Little River + Effluent)/(Total Flow)

In-stream UCBOD Mix = 20.04 (from Section 7.4 model simulations)

Q_S = stream flow in North Anna after withdrawal (cfs)

$CBOD_{u1}$ = ultimate CBOD in North Anna = 4.2 mg/l (from Table 7-1)

$CBOD_{u2}$ = ultimate CBOD in Little River = 2.5 mg/l (from Table 7-1)

Q_{LR} = 7Q10 stream flow in the Little River (cfs)

Q_D = effluent discharge flow = 6.98 cfs

S_o = effluent ultimate CBOD

F = $CBOD_u/CBOD_5$ = 4.5 (from Table 4-5)

Conversions: mg/l x MGD x 8.34 = lbs/day

MGD x 1.547 = cfs

Solving:

$$20.04 = \frac{(Q_S)(4.2) + 1.77(2.5) + 6.98(S_o)}{Q_S + 1.77 + 6.98}$$

$$20.04 = \frac{4.2(Q_S) + 4.425 + 6.98(S_o)}{Q_S + 8.75}$$

(continued)

TABLE 8-1 (continued)

DERIVATION OF CONTROL EQUATION

In terms of S_o:

$$S_o = \frac{1}{6.98} \quad 20.04(Q_s + 8.75) - 4.2\ Q_s - 4.425) \tag{2}$$

The allowable 5-day CBOD, in terms of lb/day BOD_5:

$$\text{Allowable } BOD_5 = \frac{S_o}{F}\ (8.34)\ \ Q_D$$

$$= \frac{S_o}{4.5}\ (8.34)\ \frac{6.98}{1.547}$$

This can be substituted into equation 2 and results in:

$$\text{Allowable } CBOD_5 = \frac{8.34\ (6.98)}{4.5\ (6.98)(1.547)}\ (20.04\ (Qs + 8.75) - 4.2\ Qs - 4.425) \tag{3}$$

This equation can be further simplified to:

$$\text{Allowable } CBOD_5 = 18.97\ Q_s + 204.77$$

These controls will comply with the SWCB anti-degradation policy and provide for the long-term water quality in the North Anna River.

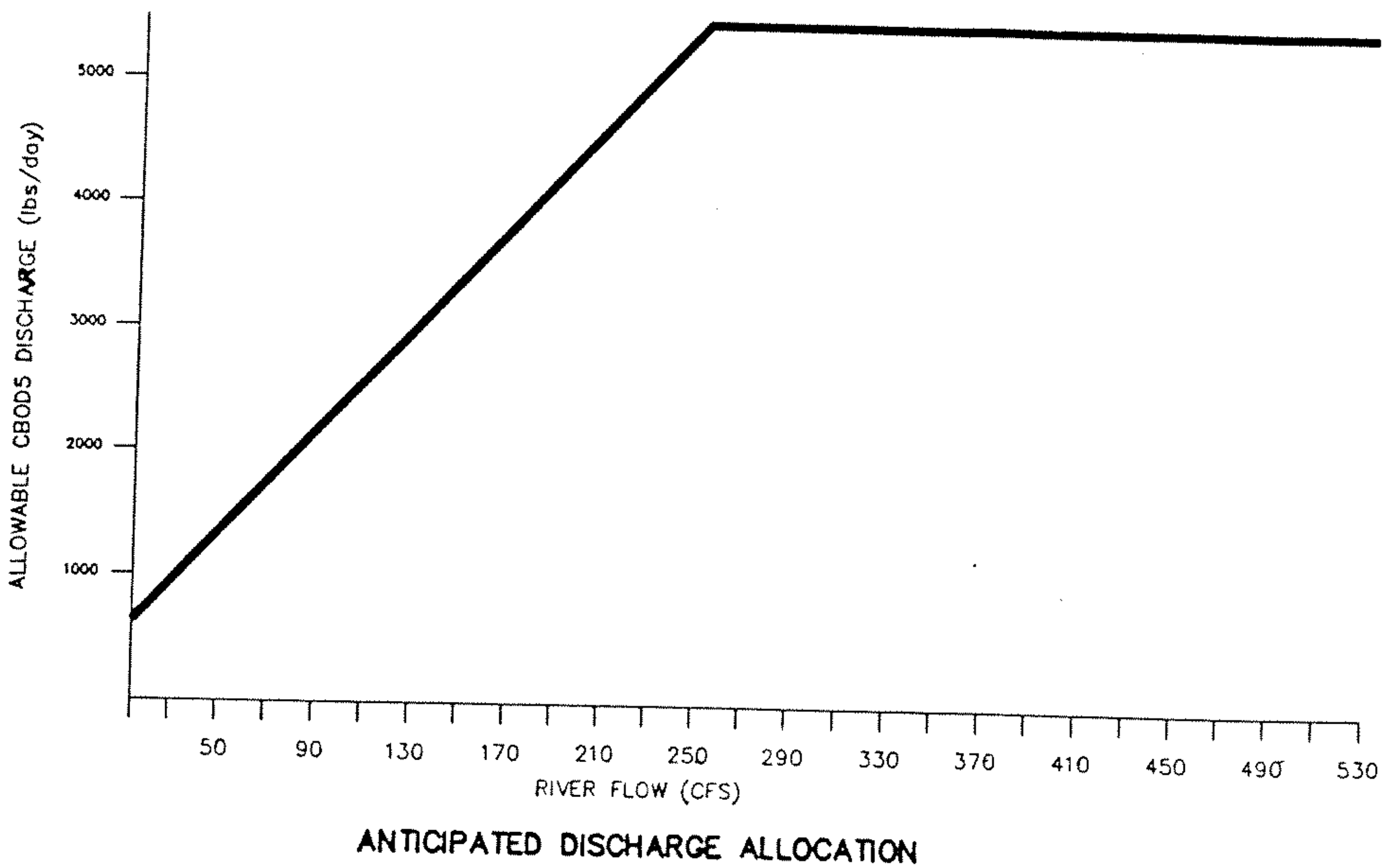


FIGURE 8-2. PROPOSED EFFLUENT CRITERIA

8.2 Oxygen Addition

The result of the modeling indicate that oxygenation of the effluent using pure oxygen will be required under low flow conditions to maintain water quality in the North Anna River. The required effluent dissolved oxygen concentrations are presented in Table 8-2. This is based on the results of the modeling presented in Table 7-2. Table 8-3 presents the North Anna River flow conditions for the various seasons where oxygen addition will not be required.

The mill uses a hydrograph-controlled release pond to store effluent under low flow conditions. With this type of storage, there are three basic discharge scenarios which can occur. These are:

1. Under normal conditions, the mill will discharge an average flow of 4.5 MGD and a maximum flow of 5.4 MGD.

2. If there are low river flow conditions, a portion of the mill effluent flow will be diverted to the hydrograph-controlled release pond.

3. If the river flow increases, then the waste stored in the hydrograph-controlled release pond will be discharged based on equation 8-2.

When there is no waste stored in the hydrograph-controlled release lagoon, the maximum discharge will be 5.4 MGD at 30 mg/l $CBOD_5$ (1,350 pounds $CBOD_5$ per day); if there is waste stored in the hydrograph-controlled-release pond, a discharge of up to 5,300 pounds $CBOD_5$ per day can occur, based on the river flow (equation 8-2).

TABLE 8-2

REQUIRED EFFLUENT DISSOLVED OXYGEN LEVEL

Season	Effluent Dissolved Oxygen[a] (mg/l)
Summer (July, August, September)	32
Fall (October, November, December)	17
Winter (January, February, March)	12
Spring (April, May, June)	27

[a] The effluent dissolved oxygen concentration is calculated through a mass balance where

DO inputs = DO mix in river

North Anna DO + Little River DO + effluent DO = DO mix in river

$$\frac{Qs\ DO_A + 1.77\ DO_B + 1.547\ Q_D\ DO_D}{Q's + 1.77 + 1.547\ Q_D} = \text{DO mix in River}$$

where

DO mix in river - from Table 7-2 (mg/l)

Qs = stream flow in North Anna after withdrawal (cfs)

DO_A = North Anna background DO, based on Table 7-2.

DO_B = Little River DO (mg/l) = DO_A

Q_D = effluent discharge flow (MGD)

DO_D = effluent DO (mg/l)

(continued)

TABLE 8-2 (continued)

REQUIRED EFFLUENT DISSOLVED OXYGEN LEVEL

For example:

at 27°C DO_A = 7.73 mg/l (from Table 7-2)

DO_B = 7.73 mg/l

Q_D = 4.5 MGD

Q_S = 41.91 - 16.28 (7Q10 conditions)

= 25.63 cfs

DO mix in river = 12.65 mg/l (from Table 7-2)

$$DO_D = \frac{(\text{DO mix in river})(Q_S + 1.77 + 1.547\ Q_D) - Q_S\ DO_A - 1.77\ DO_B}{1.547\ Q_D}$$

$$= \frac{(\ (12.65)(25.63) + 1.77 + 6.96)\ ) - (25.63)(7.73) - (1.77)(7.73)}{(1.547)(4.5)}$$

= 32 mg/l

TABLE 8-3

SUMMARY OF RIVER FLOWS WHERE PURE OXYGEN ADDITION IS NOT REQUIRED

Season	Minimum River Flow (cfs)	
	Mill Waste Discharge (5.4 MGD Max.)	Mill Waste Plus Hydrograph-Controlled Pond Discharge (21.2 MGD Max.)
Summer (July, August, September)	100	231
Fall (October, November, December)	89	202
Winter (January, February, March)	81	181
Spring (April, May, June)	95	224

For simplicity, it is proposed to operate on a two-season basis, summer and winter, with the summer season being April through September, and the winter season being October through March. For the summer season, the effluent dissolved concentration will be 32 mg/l, and during the winter season it will be 17 mg/l. The oxygen addition will be required under all conditions when the river flow is less than 100 cfs. Oxygen addition will not be required at river flows over 100 cfs, unless there is the need to discharge from the hydrograph-controlled release pond. If there is any discharge from the hydrograph-controlled release pond, oxygen addition will be required up to a river flow of 235 cfs.

A summary of the proposed regulations is presented in Table 8-4. These controls wil comply with the State Water Control Board anti-degradation policy and provide for the long-term water quality of the North Anna River.

TABLE 8-4

PROPOSED DISCHARGE CRITERIA

Season	Effluent DO Using Pure Oxygen Post-Oxygenation (mg/l)	Minimum River Flow to Switch to Cascade Aeration (cfs)	
		Mill Waste Discharge (5.4 MGD Max.)	Mill Waste Plus Hydrograph-Controlled Pond Discharge
Summer (April - September)	32	100	235
Winter (October - March)	17	100	235

Attachment 13B

(Begin at Item 12.)

Item 9: Figure 2 has been modified per your comments, with the future 1 MGD at the Doswell STP deleted, and with the oxygen supply valve position changed to the "closed" position, to reflect the correct operating scheme of the treatment system; and is included as Attachment 5.

Item 10: Item 10 - The daily flow rate is utilized in the equation and the daily flow rate is used to set the oxygen addition. The sentence in question should read "A set of controls, based on daily discharge flow, allows supplemental effluent oxygenation to be suspended when the river flow exceeds 100 cfs, when the existing cascade aeration system can be used instead."

Item 11: Item 11 - The note on Table 4 and Table 5 should be 6.5 mg/L and should read "NOTE: When switching to cascade aeration, effluent DO criteria is 6.5 mg/L". The narrative on Page 15 should read "At these minimum flow rates, the use of cascade aeration systems to oxygenate the effluent to a dissolved oxygen concentration of 6.5 mg/L is sufficient to maintain the required minimum DO conditions in the North Anna River."

Item 12: You are correct in noting that the Effluent Oxygenation Controls discussed on Page 15, in Table 5, in Table 6, and on Page 19 include an additional 1.0 MGD from the Doswell STP, even though, as is also stated in the Engineering Report, that plant expansion will not occur during the lifetime of the VPDES permit. One reason is that the design of the oxygenation system should take into account possible future expansion of Doswell, as it is anticipated that the oxygenation system will have an operating life longer than the five year term of this permit. The effect of operating under these conditions can best be observed by a comparison of the Effluent Oxygenation Controls with the Doswell expansion to the Effluent Oxygenation Controls without the Doswell expansion. Tables 5 and 6 from the Engineering Report, attached here for your convenience as Attachment 6, outlines the effluent oxygenation controls based on an average flow of 6.75 MGD and a maximum flow of 7.34 MGD (i.e., with the Doswell expansion). Tables 5a and 6a, also included in Attachment 6, outline the effluent oxygenation controls based on an average flow of 5.75 MGD and a maximum flow of 6.75 MGD (i.e., without the Doswell expansion).

4.311

Comparing the two operating schemes, the two operating schemes differ in the effluent oxygen required, and in the North Anna flow above which no supplemental oxygenation is required. The Doswell expansion causes the effluent oxygen requirement at 7Q10 flow to decrease slightly, from 29 mg/L to 27.19 mg/L in the summer and from 16 mg/L to 15.4 mg/L in the fall. Because the effluent DO concentrations in either case is lower than the effluent DO concentration of 32 mg/L and 17 mg/L originally listed in the original VPDES permit application, the original permit DO concentrations of 32 mg/L and 17 mg/L were maintained originally to avoid additional permit modifications. The correct limits for the new permit should be 29 mg/L summer and 16 mg/L winter. The higher effluent DO concentrations result in a higher in-stream DO concentration, which in turn results in a higher minimum DO concentration in the river, thus ensuring compliance with the State Water Control Board's antidegradation policy requiring a DO sag of no more than 0.2 mg/L below the critical DO in the North Anna and Pamunkey Rivers.

The Doswell expansion causes the minimum N. Anna flow above which no oxygenation is required to increase, from 111 to 121 cfs in summer and from 97 to 105 cfs in the fall. If BIPCO chooses to operate under the oxygenation control scheme outlined in Table 5 while the Doswell expansion does not occur, then more oxygen will be added to the North Anna River than estimated to be necessary to maintain the minimum DO concentration throughout the North Anna, which again will help ensure compliance with the State Water Control Board's antidegradation policy. If desired by the SWCB, the effluent oxygenation controls included in Table 5a can be utilized until the Doswell expansion occurs.

Several other items in this letter address the derivation of some of the parameters in Table 6. To avoid confusion, any questions in these areas will be answered only for the 6.75/7.34 MGD case presented in the Engineering Report. If the SWCB desires, comparable documentation for the 5.75/6.34 MGD case can be presented.

Item 13: The omitted footnote c in Table 6 states "River sections 7.4.1 through 7.4.4 ", which covers the sections of the North Anna that reflect the minimum DO conditions that Lines 5 and 7 in Table 6 are based on. Note that this footnote was included in the tables included in Attachment 6. These are the river sections included in Appendices B and C of the Engineering Report. The source of the information in Lines 5 and 7 is from the water quality model, via iterative runs to determine first the in-stream DO to maintain the minimum DO in the river (Line 5 of Table 6), then the North Anna flow above which no oxygenation is required (Line 7 of Table 6). Copies of the computer printouts showing the derivation of these values are attached as Attachment 7.

Attachment 14

Effluent Limitation Development for the Bear Island Expansion

Mixing Zone Predictions for Doswell WWTP expansion

Effluent Flow = 6.34 MGD
Stream 7Q10 = 29 MGD
Stream 30Q10 = 32 MGD
Stream 1Q10 = 27 MGD
Stream slope = 0.00038 ft/ft
Stream width = 75 ft
Bottom scale = 2
Channel scale = 1

Mixing Zone Predictions @ 7Q10

Depth = 1.5445 ft
Length = 5004.32 ft
Velocity = .4722 ft/sec
Residence Time = .1226 days

Recommendation:

A complete mix assumption is appropriate for this situation and the entire 7Q10 may be used.

Mixing Zone Predictions @ 30Q10

Depth = 1.6232 ft
Length = 4794.79 ft
Velocity = .4875 ft/sec
Residence Time = .1138 days

Recommendation:

A complete mix assumption is appropriate for this situation and the entire 30Q10 may be used.

Mixing Zone Predictions @ 1Q10

Depth = 1.4907 ft
Length = 5159.18 ft
Velocity = .4616 ft/sec
Residence Time = 3.1045 hours

Recommendation:

A complete mix assumption is appropriate for this situation providing no more than 32.21% of the 1Q10 is used.

FRESHWATER
WATER QUALITY CRITERIA / WASTELOAD ALLOCATION ANALYSIS

Facility Name: Doswell WWTP expansion   Permit No.: VA0029521

Receiving Stream: North Anna River   Version: OWP Guidance Memo 00-2011 (8/24/00)

Stream Information

Mean Hardness (as CaCO3) =	19.4	mg/L
90% Temperature (Annual) =	26.2	deg C
90% Temperature (Wet season) =		deg C
90% Maximum pH =	7.4	SU
10% Maximum pH =	6.4	SU
Tier Designation (1 or 2) =	1	
Public Water Supply (PWS) Y/N? =	n	
Trout Present Y/N? =	n	
Early Life Stages Present Y/N? =	y	

Stream Flows

1Q10 (Annual) =	27	MGD
7Q10 (Annual) =	29	MGD
30Q10 (Annual) =	32	MGD
1Q10 (Wet season) =	0	MGD
30Q10 (Wet season)	0	MGD
30Q5 =	33	MGD
Harmonic Mean =	81	MGD
Annual Average =		MGD

Mixing Information

Annual - 1Q10 Mix =	32.21	%
- 7Q10 Mix =	100	%
- 30Q10 Mix =	100	%
Wet Season - 1Q10 Mix =		%
- 30Q10 Mix =		%

Effluent Information

Mean Hardness (as CaCO3) =	562	mg/L
90% Temp (Annual) =	30.6	deg C
90% Temp (Wet season) =		deg C
90% Maximum pH =	7.9	SU
10% Maximum pH =	7.7	SU
Discharge Flow =	6.34	MGD

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				Most Limiting Allocations			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH
Acenapthene	0	--	--	na	2.7E+03	--	--	na	1.7E+04	--	--	--	--	--	--	--	--	--	--	na	1.7E+04
Acrolein	0	--	--	na	7.8E+02	--	--	na	4.8E+03	--	--	--	--	--	--	--	--	--	--	na	4.8E+03
Acrylonitrile[C]	0	--	--	na	6.6E+00	--	--	na	9.1E+01	--	--	--	--	--	--	--	--	--	--	na	9.1E+01
Aldrin [C]	0	3.0E+00	--	na	1.4E-03	7.1E+00	--	na	1.9E-02	--	--	--	--	--	--	--	--	7.1E+00	--	na	1.9E-02
Ammonia-N (mg/l) (Yearly)	0	1.85E+01	2.04E+00	na	--	4.4E+01	1.2E+01	na	--	--	--	--	--	--	--	--	--	4.4E+01	1.2E+01	na	--
Ammonia-N (mg/l) (High Flow)	0	1.01E+01	2.80E+00	na	--	1.0E+01	2.8E+00	na	--	--	--	--	--	--	--	--	--	1.0E+01	2.8E+00	na	--
Anthracene	0	--	--	na	1.1E+05	--	--	na	6.8E+05	--	--	--	--	--	--	--	--	--	--	na	6.8E+05
Antimony	0	--	--	na	4.3E+03	--	--	na	2.7E+04	--	--	--	--	--	--	--	--	--	--	na	2.7E+04
Arsenic	0	3.4E+02	1.5E+02	na	--	8.1E+02	8.4E+02	na	--	--	--	--	--	--	--	--	--	8.1E+02	8.4E+02	na	--
Barium	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Benzene [C]	0	--	--	na	7.1E+02	--	--	na	9.8E+03	--	--	--	--	--	--	--	--	--	--	na	9.8E+03
Benzidine[C]	0	--	--	na	5.4E-03	--	--	na	7.4E-02	--	--	--	--	--	--	--	--	--	--	na	7.4E-02
Benzo (a) anthracene [C]	0	--	--	na	4.9E-01	--	--	na	6.8E+00	--	--	--	--	--	--	--	--	--	--	na	6.8E+00
Benzo (b) fluoranthene [C]	0	--	--	na	4.9E-01	--	--	na	6.8E+00	--	--	--	--	--	--	--	--	--	--	na	6.8E+00
Benzo (k) fluoranthene [C]	0	--	--	na	4.9E-01	--	--	na	6.8E+00	--	--	--	--	--	--	--	--	--	--	na	6.8E+00
Benzo (a) pyrene [C]	0	--	--	na	4.9E-01	--	--	na	6.8E+00	--	--	--	--	--	--	--	--	--	--	na	6.8E+00
Bis2-Chloroethyl Ether	0	--	--	na	1.4E+01	--	--	na	8.7E+01	--	--	--	--	--	--	--	--	--	--	na	8.7E+01
Bis2-Chloroisopropyl Ether	0	--	--	na	1.7E+05	--	--	na	1.1E+06	--	--	--	--	--	--	--	--	--	--	na	1.1E+06
Bromoform [C]	0	--	--	na	3.6E+03	--	--	na	5.0E+04	--	--	--	--	--	--	--	--	--	--	na	5.0E+04
Butylbenzylphthalate	0	--	--	na	5.2E+03	--	--	na	3.2E+04	--	--	--	--	--	--	--	--	--	--	na	3.2E+04
Cadmium	0	1.1E+01	1.3E+00	na	--	2.6E+01	7.1E+00	na	--	--	--	--	--	--	--	--	--	2.6E+01	7.1E+00	na	--
Carbon Tetrachloride [C]	0	--	--	na	4.4E+01	--	--	na	6.1E+02	--	--	--	--	--	--	--	--	--	--	na	6.1E+02
Chlordane [C]	0	2.4E+00	4.3E-03	na	2.2E-02	5.7E+00	2.4E-02	na	3.0E-01	--	--	--	--	--	--	--	--	5.7E+00	2.4E-02	na	3.0E-01
Chloride	0	8.6E+05	2.3E+05	na	--	2.0E+06	1.3E+06	na	--	--	--	--	--	--	--	--	--	2.0E+06	1.3E+06	na	--
TRC	0	1.9E+01	1.1E+01	na	--	4.5E+01	6.1E+01	na	--	--	--	--	--	--	--	--	--	4.5E+01	6.1E+01	na	--
Chlorobenzene	0	--	--	na	2.1E+04	--	--	na	1.3E+05	--	--	--	--	--	--	--	--	--	--	na	1.3E+05

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				Most Limiting Allocations			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH
Chlorodibromomethane[C]	0	--	--	na	3.4E+02	--	--	na	4.7E+03	--	--	--	--	--	--	--	--	--	--	na	4.7E+03
Chloroform [C]	0	--	--	na	2.9E+04	--	--	na	4.0E+05	--	--	--	--	--	--	--	--	--	--	na	4.0E+05
2-Chloronaphthalene	0	--	--	na	4.3E+03	--	--	na	2.7E+04	--	--	--	--	--	--	--	--	--	--	na	2.7E+04
2-Chlorophenol	0	--	--	na	4.0E+02	--	--	na	2.5E+03	--	--	--	--	--	--	--	--	--	--	na	2.5E+03
Chlorpyrifos	0	8.3E-02	4.1E-02	na	--	2.0E-01	2.3E-01	na	--	--	--	--	--	--	--	--	--	2.0E-01	2.3E-01	na	--
Chromium III	0	1.2E+03	8.4E+01	na	--	2.8E+03	4.7E+02	na	--	--	--	--	--	--	--	--	--	2.8E+03	4.7E+02	na	--
Chromium VI	0	1.6E+01	1.1E+01	na	--	3.8E+01	6.1E+01	na	--	--	--	--	--	--	--	--	--	3.8E+01	6.1E+01	na	--
Chromium, Total	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Chrysene [C]	0	--	--	na	4.9E-01	--	--	na	6.8E+00	--	--	--	--	--	--	--	--	--	--	na	6.8E+00
Copper	0	3.2E+01	1.0E+01	na	--	7.5E+01	5.7E+01	na	--	--	--	--	--	--	--	--	--	7.5E+01	5.7E+01	na	--
Cyanide	0	2.2E+01	5.2E+00	na	2.2E+05	5.2E+01	2.9E+01	na	1.3E+06	--	--	--	--	--	--	--	--	5.2E+01	2.9E+01	na	1.3E+06
DDD [C]	0	--	--	na	8.4E-03	--	--	na	1.2E-01	--	--	--	--	--	--	--	--	--	--	na	1.2E-01
DDE [C]	0	--	--	na	5.9E-03	--	--	na	8.1E-02	--	--	--	--	--	--	--	--	--	--	na	8.1E-02
DDT [C]	0	1.1E+00	1.0E-03	na	5.9E-03	2.6E+00	5.6E-03	na	8.1E-02	--	--	--	--	--	--	--	--	2.6E+00	5.6E-03	na	8.1E-02
Demeton	0	--	1.0E-01	na	--	--	5.6E-01	na	--	--	--	--	--	--	--	--	--	--	5.6E-01	na	--
Dibenz(a,h)anthracene [C]	0	--	--	na	4.9E-01	--	--	na	6.8E+00	--	--	--	--	--	--	--	--	--	--	na	6.8E+00
Dibutyl phthalate	0	--	--	na	1.2E+04	--	--	na	7.4E+04	--	--	--	--	--	--	--	--	--	--	na	7.4E+04
Dichloromethane (Methylene Chloride) [C]	0	--	--	na	1.6E+04	--	--	na	2.2E+05	--	--	--	--	--	--	--	--	--	--	na	2.2E+05
1,2-Dichlorobenzene	0	--	--	na	1.7E+04	--	--	na	1.1E+05	--	--	--	--	--	--	--	--	--	--	na	1.1E+05
1,3-Dichlorobenzene	0	--	--	na	2.6E+03	--	--	na	1.6E+04	--	--	--	--	--	--	--	--	--	--	na	1.6E+04
1,4-Dichlorobenzene	0	--	--	na	2.6E+03	--	--	na	1.6E+04	--	--	--	--	--	--	--	--	--	--	na	1.6E+04
3,3-Dichlorobenzidine[C]	0	--	--	na	7.7E-01	--	--	na	1.1E+01	--	--	--	--	--	--	--	--	--	--	na	1.1E+01
Dichlorobromomethane [C]	0	--	--	na	4.6E+02	--	--	na	6.3E+03	--	--	--	--	--	--	--	--	--	--	na	6.3E+03
1,2-Dichloroethane [C]	0	--	--	na	9.9E+02	--	--	na	1.4E+04	--	--	--	--	--	--	--	--	--	--	na	1.4E+04
1,1-Dichloroethylene	0	--	--	na	1.7E+04	--	--	na	1.1E+05	--	--	--	--	--	--	--	--	--	--	na	1.1E+05
1,2-trans-dichloroethylene	0	--	--	na	1.4E+05	--	--	na	8.7E+05	--	--	--	--	--	--	--	--	--	--	na	8.7E+05
2,4-Dichlorophenol	0	--	--	na	7.9E+02	--	--	na	4.9E+03	--	--	--	--	--	--	--	--	--	--	na	4.9E+03
2,4-Dichlorophenoxy acetic acid (2,4-D)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
1,2-Dichloropropane[C]	0	--	--	na	3.9E+02	--	--	na	5.4E+03	--	--	--	--	--	--	--	--	--	--	na	5.4E+03
1,3-Dichloropropene	0	--	--	na	1.7E+03	--	--	na	1.1E+04	--	--	--	--	--	--	--	--	--	--	na	1.1E+04
Dieldrin [C]	0	2.4E-01	5.6E-02	na	1.4E-03	5.7E-01	3.1E-01	na	1.9E-02	--	--	--	--	--	--	--	--	5.7E-01	3.1E-01	na	1.9E-02
Diethyl Phthalate	0	--	--	na	1.2E+05	--	--	na	7.4E+05	--	--	--	--	--	--	--	--	--	--	na	7.4E+05
Di-2-Ethylhexyl Phthalate [C]	0	--	--	na	5.9E+01	--	--	na	8.1E+02	--	--	--	--	--	--	--	--	--	--	na	8.1E+02
2,4-Dimethylphenol	0	--	--	na	2.3E+03	--	--	na	1.4E+04	--	--	--	--	--	--	--	--	--	--	na	1.4E+04
Dimethyl Phthalate	0	--	--	na	2.9E+06	--	--	na	1.8E+07	--	--	--	--	--	--	--	--	--	--	na	1.8E+07
Di-n-Butyl Phthalate	0	--	--	na	1.2E+04	--	--	na	7.4E+04	--	--	--	--	--	--	--	--	--	--	na	7.4E+04
2,4 Dinitrophenol	0	--	--	na	1.4E+04	--	--	na	8.7E+04	--	--	--	--	--	--	--	--	--	--	na	8.7E+04
2-Methyl-4,6-Dinitrophenol	0	--	--	na	7.65E+02	--	--	na	4.7E+03	--	--	--	--	--	--	--	--	--	--	na	4.7E+03
2,4-Dinitrotoluene [C]	0	--	--	na	9.1E+01	--	--	na	1.3E+03	--	--	--	--	--	--	--	--	--	--	na	1.3E+03
Dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin) (ppq)	0	--	--	na	1.2E-06	--	--	na	na	--	--	--	--	--	--	--	--	--	--	na	na
1,2-Diphenylhydrazine[C]	0	--	--	na	5.4E+00	--	--	na	7.4E+01	--	--	--	--	--	--	--	--	--	--	na	7.4E+01
Alpha-Endosulfan	0	2.2E-01	5.6E-02	na	2.4E+02	5.2E-01	3.1E-01	na	1.5E+03	--	--	--	--	--	--	--	--	5.2E-01	3.1E-01	na	1.5E+03
Beta-Endosulfan	0	2.2E-01	5.6E-02	na	2.4E+02	5.2E-01	3.1E-01	na	1.5E+03	--	--	--	--	--	--	--	--	5.2E-01	3.1E-01	na	1.5E+03
Endosulfan Sulfate	0	--	--	na	2.4E+02	--	--	na	1.5E+03	--	--	--	--	--	--	--	--	--	--	na	1.5E+03
Endrin	0	8.6E-02	3.6E-02	na	8.1E-01	2.0E-01	2.0E-01	na	5.0E+00	--	--	--	--	--	--	--	--	2.0E-01	2.0E-01	na	5.0E+00
Endrin Aldehyde	0	--	--	na	8.1E-01	--	--	na	5.0E+00	--	--	--	--	--	--	--	--	--	--	na	5.0E+00

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				Most Limiting Allocations			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH
Ethylbenzene	0	--	--	na	2.9E+04	--	--	na	1.8E+05	--	--	--	--	--	--	--	--	--	--	na	1.8E+05
Fluoranthene	0	--	--	na	3.7E+02	--	--	na	2.3E+03	--	--	--	--	--	--	--	--	--	--	na	2.3E+03
Fluorene	0	--	--	na	1.4E+04	--	--	na	8.7E+04	--	--	--	--	--	--	--	--	--	--	na	8.7E+04
Foaming Agents	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Guthion	0	--	1.0E-02	na	--	--	5.6E-02	na	--	--	--	--	--	--	--	--	--	--	5.6E-02	na	--
Heptachlor [C]	0	5.2E-01	3.8E-03	na	2.1E-03	1.2E+00	2.1E-02	na	2.9E-02	--	--	--	--	--	--	--	--	1.2E+00	2.1E-02	na	2.9E-02
Heptachlor Epoxide [C]	0	5.2E-01	3.8E-03	na	1.1E-03	1.2E+00	2.1E-02	na	1.5E-02	--	--	--	--	--	--	--	--	1.2E+00	2.1E-02	na	1.5E-02
Hexachlorobenzene [C]	0	--	--	na	7.7E-03	--	--	na	1.1E-01	--	--	--	--	--	--	--	--	--	--	na	1.1E-01
Hexachlorobutadiene [C]	0	--	--	na	5.0E+02	--	--	na	6.9E+03	--	--	--	--	--	--	--	--	--	--	na	6.9E+03
Hexachlorocyclohexane Alpha-BHC [C]	0	--	--	na	1.3E-01	--	--	na	1.8E+00	--	--	--	--	--	--	--	--	--	--	na	1.8E+00
Hexachlorocyclohexane Beta-BHC [C]	0	--	--	na	4.6E-01	--	--	na	6.3E+00	--	--	--	--	--	--	--	--	--	--	na	6.3E+00
Hexachlorocyclohexane Gamma-BHC [C] (Lindane)	0	9.5E-01	na	na	6.3E-01	2.3E+00	--	na	8.7E+00	--	--	--	--	--	--	--	--	2.3E+00	--	na	8.7E+00
Hexachlorocyclopentadiene	0	--	--	na	1.7E+04	--	--	na	1.1E+05	--	--	--	--	--	--	--	--	--	--	na	1.1E+05
Hexachloroethane [C]	0	--	--	na	8.9E+01	--	--	na	1.2E+03	--	--	--	--	--	--	--	--	--	--	na	1.2E+03
Hydrogen Sulfide	0	--	2.0E+00	na	--	--	1.1E+01	na	--	--	--	--	--	--	--	--	--	--	1.1E+01	na	--
Indeno (1,2,3-cd) pyrene [C]	0	--	--	na	4.9E-01	--	--	na	6.8E+00	--	--	--	--	--	--	--	--	--	--	na	6.8E+00
Iron	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Isophorone [C]	0	--	--	na	2.6E+04	--	--	na	3.6E+05	--	--	--	--	--	--	--	--	--	--	na	3.6E+05
Kepone	0	--	0.0E+00	na	--	--	0.0E+00	na	--	--	--	--	--	--	--	--	--	--	0.0E+00	na	--
Lead	0	3.8E+02	1.6E+01	na	--	9.0E+02	9.2E+01	na	--	--	--	--	--	--	--	--	--	9.0E+02	9.2E+01	na	--
Malathion	0	--	1.0E-01	na	--	--	5.6E-01	na	--	--	--	--	--	--	--	--	--	--	5.6E-01	na	--
Manganese	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Mercury	0	1.4E+00	7.7E-01	na	5.1E-02	3.3E+00	4.3E+00	na	3.2E-01	--	--	--	--	--	--	--	--	3.3E+00	4.3E+00	na	3.2E-01
Methyl Bromide	0	--	--	na	4.0E+03	--	--	na	2.5E+04	--	--	--	--	--	--	--	--	--	--	na	2.5E+04
Methoxychlor	0	--	3.0E-02	na	--	--	1.7E-01	na	--	--	--	--	--	--	--	--	--	--	1.7E-01	na	--
Mirex	0	--	0.0E+00	na	--	--	0.0E+00	na	--	--	--	--	--	--	--	--	--	--	0.0E+00	na	--
Monochlorobenzene	0	--	--	na	2.1E+04	--	--	na	1.3E+05	--	--	--	--	--	--	--	--	--	--	na	1.3E+05
Nickel	0	3.9E+02	2.3E+01	na	4.6E+03	9.3E+02	1.3E+02	na	2.9E+04	--	--	--	--	--	--	--	--	9.3E+02	1.3E+02	na	2.9E+04
Nitrate (as N)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Nitrobenzene	0	--	--	na	1.9E+03	--	--	na	1.2E+04	--	--	--	--	--	--	--	--	--	--	na	1.2E+04
N-Nitrosodimethylamine [C]	0	--	--	na	8.1E+01	--	--	na	1.1E+03	--	--	--	--	--	--	--	--	--	--	na	1.1E+03
N-Nitrosodiphenylamine [C]	0	--	--	na	1.6E+02	--	--	na	2.2E+03	--	--	--	--	--	--	--	--	--	--	na	2.2E+03
N-Nitrosodi-n-propylamine [C]	0	--	--	na	1.4E+01	--	--	na	1.9E+02	--	--	--	--	--	--	--	--	--	--	na	1.9E+02
Parathion	0	6.5E-02	1.3E-02	na	--	1.5E-01	7.2E-02	na	--	--	--	--	--	--	--	--	--	1.5E-01	7.2E-02	na	--
PCB-1016	0	--	1.4E-02	na	--	--	7.8E-02	na	--	--	--	--	--	--	--	--	--	--	7.8E-02	na	--
PCB-1221	0	--	1.4E-02	na	--	--	7.8E-02	na	--	--	--	--	--	--	--	--	--	--	7.8E-02	na	--
PCB-1232	0	--	1.4E-02	na	--	--	7.8E-02	na	--	--	--	--	--	--	--	--	--	--	7.8E-02	na	--
PCB-1242	0	--	1.4E-02	na	--	--	7.8E-02	na	--	--	--	--	--	--	--	--	--	--	7.8E-02	na	--
PCB-1248	0	--	1.4E-02	na	--	--	7.8E-02	na	--	--	--	--	--	--	--	--	--	--	7.8E-02	na	--
PCB-1254	0	--	1.4E-02	na	--	--	7.8E-02	na	--	--	--	--	--	--	--	--	--	--	7.8E-02	na	--
PCB-1260	0	--	1.4E-02	na	--	--	7.8E-02	na	--	--	--	--	--	--	--	--	--	--	7.8E-02	na	--
PCB Total [C]	0	--	--	na	1.7E-03	--	--	na	2.3E-02	--	--	--	--	--	--	--	--	--	--	na	2.3E-02

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				Most Limiting Allocations			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH
Pentachlorophenol [C]	0	6.0E+00	4.0E+00	na	8.2E+01	1.4E+01	2.2E+01	na	1.1E+03	--	--	--	--	--	--	--	--	**1.4E+01**	**2.2E+01**	**na**	**1.1E+03**
Phenol	0	--	--	na	4.6E+06	--	--	na	2.9E+07	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.9E+07**
Pyrene	0	--	--	na	1.1E+04	--	--	na	6.8E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.8E+04**
Radionuclides (pCi/l except Beta/Photon)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Gross Alpha Activity	0	--	--	na	1.5E+01	--	--	na	9.3E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.3E+01**
Beta and Photon Activity (mrem/yr)	0	--	--	na	4.0E+00	--	--	na	2.5E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.5E+01**
Strontium-90	0	--	--	na	8.0E+00	--	--	na	5.0E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.0E+01**
Tritium	0	--	--	na	2.0E+04	--	--	na	1.2E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.2E+05**
Selenium	0	2.0E+01	5.0E+00	na	1.1E+04	4.7E+01	2.8E+01	na	6.8E+04	--	--	--	--	--	--	--	--	**4.7E+01**	**2.8E+01**	**na**	**6.8E+04**
Silver	0	1.6E+01	--	na	--	3.9E+01	--	na	--	--	--	--	--	--	--	--	--	**3.9E+01**	**--**	**na**	**--**
Sulfate	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
1,1,2,2-Tetrachloroethane[C]	0	--	--	na	1.1E+02	--	--	na	1.5E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+03**
Tetrachloroethylene[C]	0	--	--	na	8.9E+01	--	--	na	1.2E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.2E+03**
Thallium	0	--	--	na	6.3E+00	--	--	na	3.9E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**3.9E+01**
Toluene	0	--	--	na	2.0E+05	--	--	na	1.2E+06	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.2E+06**
Total dissolved solids	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Toxaphene [C]	0	7.3E-01	2.0E-04	na	7.5E-03	1.7E+00	1.1E-03	na	1.0E-01	--	--	--	--	--	--	--	--	**1.7E+00**	**1.1E-03**	**na**	**1.0E-01**
Tributyltin	0	4.6E-01	6.3E-02	na	--	1.1E+00	3.5E-01	na	--	--	--	--	--	--	--	--	--	**1.1E+00**	**3.5E-01**	**na**	**--**
1,2,4-Trichlorobenzene	0	--	--	na	9.4E+02	--	--	na	5.8E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.8E+03**
1,1,2-Trichloroethane[C]	0	--	--	na	4.2E+02	--	--	na	5.8E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.8E+03**
Trichloroethylene [C]	0	--	--	na	8.1E+02	--	--	na	1.1E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.1E+04**
2,4,6-Trichlorophenol [C]	0	--	--	na	6.5E+01	--	--	na	9.0E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.0E+02**
2-(2,4,5-Trichlorophenoxy) propionic acid (Silvex)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Vinyl Chloride[C]	0	--	--	na	6.1E+01	--	--	na	8.4E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.4E+02**
Zinc	0	2.5E+02	1.3E+02	na	6.9E+04	6.0E+02	7.5E+02	na	4.3E+05	--	--	--	--	--	--	--	--	**6.0E+02**	**7.5E+02**	**na**	**4.3E+05**

Notes:

1. All concentrations expressed as micrograms/liter (ug/l), unless noted otherwise
2. Discharge flow is highest monthly average or Form 2C maximum for Industries and design flow for Municipals
3. Metals measured as Dissolved, unless specified otherwise
4. "C" indicates a carcinogenic parameter
5. Regular WLAs are mass balances (minus background concentration) using the % of stream flow entered above under Mixing Information.
   Antidegradation WLAs are based upon a complete mix.
6. Antideg. Baseline = (0.25(WQC - background conc.) + background conc.) for acute and chronic
   = (0.1(WQC - background conc.) + background conc.) for human health
7. WLAs established at the following stream flows: 1Q10 for Acute, 30Q10 for Chronic Ammonia, 7Q10 for Other Chronic, 30Q5 for Non-carcinogens,
   Harmonic Mean for Carcinogens, and Annual Average for Dioxin. Mixing ratios may be substituted for stream flows where appropriate.

Metal	Target Value (SSTV)
Antimony	2.7E+04
Arsenic	3.2E+02
Barium	na
Cadmium	4.3E+00
Chromium III	2.8E+02
Chromium VI	1.5E+01
Copper	3.0E+01
Iron	na
Lead	5.5E+01
Manganese	na
Mercury	3.2E-01
Nickel	7.7E+01
Selenium	1.7E+01
Silver	1.6E+01
Zinc	2.4E+02

Note: do not use QL's lower than the minimum QL's provided in agency guidance

Facility = Doswell WWTP expansion
Chemical = Ammonia
Chronic averaging period = 30
WLAa = 44
WLAc = 12
Q.L. = .2
# samples/mo. = 30
# samples/wk. = 8

Summary of Statistics:

observations = 1
Expected Value = 6
Variance = 12.96
C.V. = 0.6
97th percentile daily values = 14.6005
97th percentile 4 day average = 9.98274
97th percentile 30 day average = 7.23631
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:

6

Guidance Memorandum No. 00-2011 directs that an ammonia effluent concentration of 9 mg/L be used to evaluate the need for an ammonia limitation for a municipal discharge. Although this discharge consists predominantly of industrial wastewater, it is reasonable to check to see if the cited guidance would result in a limitation. In this case, the permit already limits TKN to 10 mg/L. Ammonia typically makes up 40% to 60% of the TKN in a municipal effluent. Ammonia makes up 46% of the TKN in the Bear Island wastewater (see "Outfall 001 – Supplement to Table I"). Using 60% as a worse case scenario, the ammonia concentration could be as high 6.0 mg/L, which is the concentration used in the above analysis (10 x 0.6 = 6). The above result that "no limit is required" establishes that the TKN limitation is also protective of the ammonia water quality standard. Note that the number of samples per month used in the above analysis matches the frequency of BOD monitoring.

Facility = Doswell WWTP expansion
Chemical = Chloride
Chronic averaging period = 4
WLAa = 2000000
WLAc = 1300000
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 1
Expected Value = 29000
Variance = 3027600
C.V. = 0.6
97th percentile daily values = 70569.1
97th percentile 4 day average = 48249.9
97th percentile 30 day average = 34975.5
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:

29000

Facility = Doswell WWTP expansion
Chemical = Total Residual Chlorine
Chronic averaging period = 4
WLAa = 45
WLAc = 61

Q.L. = 0.1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 3
Expected Value = 360
Variance = 46656
C.V. = 0.6
97th percentile daily values = 876.030
97th percentile 4 day average = 598.964
97th percentile 30 day average = 434.179
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

A limit is needed based on Acute Toxicity

Maximum Daily Limit = 45
Average Weekly Limit = 45
Average Monthly Limit = 45

The data are:

190
410
480

Chlorine is not used for disinfection at the Doswell treatment plant and chlorine is not used in the Bear Island process. The above concentrations were determined in conjunction with the failed *Ceriodaphnia dubia* chronic bioassay test in March 2007 (see Attachment 8). These TRC concentrations are believed to be false positives due to possible interference by manganese or alkalinity. Because chlorine is not used at either site, limitations are not included in the draft permit. (It is not appropriate to "force" chlorine limitations with an input of value of 20,000 µg/L per Guidance Memorandum No. 00-2011 because chlorine is not added to the system at any point.)

Facility = Doswell WWTP expansion
Chemical = Dissolved Copper
Chronic averaging period = 4
WLAa = 75
WLAc = 57
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 1
Expected Value = 6
Variance = 12.96
C.V. = 0.6
97th percentile daily values = 14.6005
97th percentile 4 day average = 9.98274
97th percentile 30 day average = 7.23631
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:

6

The dissolved copper data reported with the permit renewal application were 6 µg/L, <5 µg/L, and <5 µg/L (see Attachment 6A). In accordance with a memorandum dated January 29, 2003 from Allan Brockenbrough regarding mixed data sets that include censored data (values reported as less than a quantification limit (QL)) and uncensored data (>QL; i.e., a real number), the reasonable potential analysis is initially done using only the uncensored data. If limitations are not indicated, then the analysis is complete. That is the case with the copper data.

Facility = Doswell WWTP expansion
Chemical = Cyanide
Chronic averaging period = 4
WLAa = 52
WLAc = 29
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 2
Expected Value = 10.5
Variance = 39.69
C.V. = 0.6
97th percentile daily values = 25.5508
97th percentile 4 day average = 17.4697
97th percentile 30 day average = 12.6635
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:

11
10

The cyanide data reported with the permit renewal application were 11 µg/L, 10 µg/L, and <10 µg/L (see Attachment 6A). In accordance with a memorandum dated January 29, 2003 from Allan Brockenbrough regarding mixed data sets that include censored data (values reported as less than a quantification limit (QL)) and uncensored data (>QL; i.e., a real number), the reasonable potential analysis is initially done using only the uncensored data. If limitations are not indicated, then the analysis is complete. That is the case with the cyanide data. Note in Attachment 6A that a cyanide study was conducted starting in March 2004 and ending in October 2005. The above data are consistent with the data collected during that study period. Although the data from the cyanide study are more than three years old, they are still representative and could have been included in the above analysis. The above analysis using only two data points is a more extreme analysis however, which indicates that limitations are not needed.

Facility = Doswell WWTP expansion
Chemical = Dissolved Lead
Chronic averaging period = 4
WLAa = 900
WLAc = 92
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 1
Expected Value = 30
Variance = 324
C.V. = 0.6
97th percentile daily values = 73.0025
97th percentile 4 day average = 49.9137
97th percentile 30 day average = 36.1815
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:

30

The dissolved lead data reported with the permit renewal application were (all in µg/L): <20, <20, 30, <20, <20, <20, <20, <20, <20, and <20 (see Attachment 6A). In accordance with a memorandum dated January 29, 2003 from Allan Brockenbrough regarding mixed data sets that include censored data (values reported as less than a quantification limit (QL)) and uncensored data (>QL; i.e., a real number), the reasonable potential analysis is initially done using only the uncensored data. If limitations are not indicated, then the analysis is complete. That is the case with the lead data.

Facility = Doswell WWTP expansion
Chemical = Dissolved Zinc
Chronic averaging period = 4
WLAa = 600
WLAc = 750
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 11
Expected Value = 133.937
Variance = 1605.77
C.V. = 0.299185
97th percentile daily values = 222.573
97th percentile 4 day average = 175.236
97th percentile 30 day average = 147.698
< Q.L. = 0
Model used = lognormal

No Limit is required for this material

The data are:

108
101
134
218
173
98
113
110
104
109
204